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Remarks on the Form of Numbers, the Method of Using them, and the Numerical Categories found in the Mahābhārata.—By E. WASHBURN HOPKINS, Professor in Yale University, New Haven, Conn.

THESE Remarks on Numbers are incidental notes which I made a short time ago, while collecting from the great Hindu epic some material intended for another purpose. They were presented in outline as one paper at the meeting of the Society in April of this year, but as they are rather too long to be printed all at one time in the *Journal*, I purpose to bring them out in sections in successive half-volumes. The general plan of arrangement is as follows:

The form of epic numbers.

How numbers are handled in arithmetical processes.

How space (dimension, etc.) is measured (norms and syntax).

Time-words and methods of measuring time (months, asterisms, etc.); syntax of time expressions; time-phrases; age; epic dates (excursus).

The epic world according to the categories of the poets (physical, ethical, etc.).

Various problems, historical as well as philological, serve to relieve the dryness of the subject, but these will be touched only by the way, as my chief object is to get data together, though I have not avoided mention of obvious differences in matters pertaining to the growth of the epic. The present paper includes the first three divisions. The next will treat of time-words (to epic dates), with subsequent divisions according to circumstances.

Before taking up seriatim peculiar forms of numbers, I would call attention to certain fanciful number-words which belong to the later epic. The most striking of these is *daçārdha*, not merely as “five,” *daçārdhasamkhyāḥ* (*garāḥ*), i. 188. 20; *daçārdhahavirātmakaḥ*, xii. 47. 42,¹ but as “fist” (the half-ten fingers):

¹ Compare the abstract, *daçārdhatā=pañcatva*, xii. 187. 27, dissolution into five elements (ib. 291. 10, *daçārdhapravibhakta*).

xii. 114. 20, *kruddho daçārdhena hi tādayed vā.*

Analogous is *pañcaçākha*, “having five branches,” the hand:

xi. 17. 30, *svaçirah pañcaçākhābhyaṁ abhihatya,*

which illustrates Nala v. 5. In the Rāmāyana, vi. 59. 55, this word is still an adjective to *bāhu*. Compare RV. x. 137. 7, *daçaçākhābhyaṁ (hastābhyaṁ)*.

I have elsewhere suggested that the word for four appears to be a combination of “three and.” That the digits, as well as the higher numbers, were indicated by addition is shown by many examples of “and” combinations to express them, for example, in i. 234. 15, six is expressed by “five and one,” *pañca cāi 'kam ca*. Double-six (*ṣatka* for six) reflects a common doublet, the year consisting of two six-month “courses” of the sun, *dviṣatkapadagāmin*, xi. 5. 15. Such “double” terms are not rare: “double-five-headed,” *dvipañcaçirasaḥ kecit*, v. 103. 7; *dvipañcarātra*, iii. 230. 37; *dviṣadakṣa*, “with twelve eyes,” xiii. 86. 19; while for twenty-one, “thrice seven” is normal, *trisaptan*, sic, *triṣaptakṛtvah*.

I have no record of alternate adjective numerals, such as *dvitra* or *tricatura* among epic material; but unexpressed alternates are found: “five or six mouthfuls,” *pañca sat*; “for seven or eight days,” *saptāṣṭha divasān*, v. 160. 40; “even (opposed to fifty) five or six or seven,” *api vā pañca ṣat sapta*, vi. 3. 83, also xii. 102. 21; “of ten or twelve” (years), *daçadvādaça-*, iii. 188. 60. Compare *dvyeka-*, “of two or of one,” Manu, x. 7. For triad, *tritayam* and *trayam* (in i. 2. 329, etc., *catastra-yam*) are used indifferently; in xiii. 111. 18–19, side by side:

*dharmaç cā 'rthaç ca kāmaç ca tritayam jīvite phalam
etat trayam avāptavyam.*

This is the usual triad to be desiderated, but it is often alluded to as a triad without definition, as in ix. 64. 21, *tritayam sevitam sarvam*. It is possible that it means trinity in xiii. 147. 53, where Çiva says of Viṣṇu:

*tatra ca tritayam dṛṣṭam bhavisyati na samçayaḥ
samastā hi vayam devās tasya dehe vasāmahe,*

though even here it may, as usual, be equivalent to the *trivarga* called *tritaya* above (rather than the three times, as suggested in PW.). *Tretā* for triad is rather affected in the later epic

and (without the implied complement) stands alone for a Yuga and for the group of three fires (ref. PW.); *trika* is used sparingly, *pañcatrika*, having a triad of five, fifteen; *tritva* is a late solecism (ref. below). A group of four is *catusṭayam* or *catusṭakam*; a group of five, *pañcakam*, etc.

Metaphorical number-names I have illustrated by a passage cited in my *Great Epic*, p. 206, where *carāgni* is 5×7 . The passage, however, is late and unique in the epic.

I turn now to the regular numbers.

The epic is not so careless of art as to change the grammatical form of all the numbers, but it contains several abnormal numerals. I shall speak of the form of the numbers three, four, seven, eight, nine, ten, adding something on derivatives of the word for one, and the use of the higher numbers.

Tri. In the Sanatsujāta Parvan, which is a late imitation of ancient matter, occurs this verse :

v. 43. 15, *tathā nr̥gañśāni daça tri, rājan.*

In gl. 19 are mentioned seven cases of cruelty, which apparently led Telang, *SBE.*, viii. p. 168, to translate the words above “and likewise the seven cruelties.” But the seven of gl. 19 are expressly differentiated from six that precede, *ete pare sapta*, “seven other cases,” and it is these six and seven together which make up the thirteen, *daça tri*, mentioned in the introductory fifteenth cloka. Consequently, Nilakantha is right in saying that *daça tri* is for *trayodaça*, or, in other words, *tri* heré stands for *trīṇi*.

In the last number of this *Journal*, xxii, p. 345 ff., I pointed out an epic case of a dropped ending, *daça-dvādaṣṭabhir vā'pi*, where the *vā* shows clearly that *daça* stands for *daṣṭabhiḥ*, which has lost its ending because it is supplied by the next word.¹ A still more extraordinary case of dislocated ending is found in that book which historical critique has pronounced later than the early epic:

iv. 62. 14, *avaruddho 'carat Pārtho varṣāṇi tri daçāṇi ca,*

¹ The meter here shows that the corrupt form is intentional. The case differs, therefore, from that of the ČB. *yajus*, *Mitrāya Varuṇāya ca*, which all MSS. of JB., Professor Oertel informs me, have as *Mitrā-varuṇāya ca*, since the latter form spoils the meter.

where *tri daçāni* stands for thirteen. Here we cannot read *tri-daçāni*, for two reasons. First, this word means thirty and not thirteen, and thirteen is the required meaning. Second, even if we took *tridaçāni* as an adjective meaning thirteen, there would still remain the *ca*, which only a very strained interpretation could dispose of otherwise than as Nilakantha has said (*triñi ca daça ca*). There remains only the explanation that in *tridaçāni* the poet has transposed the endings for metrical purposes and not only written *tri* for *triñi* but *daçāni* for *daça*, helped thereto undoubtedly by the preceding *varṣāni*. Such a monstrosity is one that need not surprise us among the many evidences of lateness found in the *Virāṭa*, which, as a whole, lies nearest to the pseudo-epic in its disregard of Sanskrit grammar as in other particulars. So in *Virāṭa* we find the slovenly construction of iv. 39. 10, *jitvā vayam neṣyati ca 'dyā gāvah*, “conquer us and carry off the cows,” a verse admitted by Nilakantha (compare 47. 34), and quite comparable with the looseness of form found in *Cānti*.

The PW. has already noticed, i. 113. 21, *vihṛtya tridaçāniçāḥ*, for *triñcat*; *tridaçāu*, iii. 123. 1 (*Açvināu*); and *tridaçāḥ*, 3×10 (=33) gods, passim.

Catur. Professor Holtzmann, in his *Anhang* to Whitney's *Grammar*, § 482, mentions *caturaḥ* as nominative in xii. 24. 27 and *catur* as accusative, *vedān*, in iii. 45. 8. Both forms are found elsewhere as well. In vii. 149. 22, *gāyanti caturo vedāḥ*; vii. 202. 74, *vedān kṛtvā 'tha caturaç catur agravān maheçvaraḥ*. Also in viii. 34. 70, *tathā 'va vedāç caturo hayāgryāḥ*. All these passages are late laudations or describe metaphorical “cars” of religion, the four Vedas being made the steeds. Unique is viii. 20. 49, *sa tu dvipah pañcabhir uttameśubhiḥ kṛtaḥ sadañçāç caturo nrpaḥ tribhiḥ* (“the elephant with five arrows made six-fold [cut into six pieces] and the king with three (arrows made) four”), *kṛto daçāñçāḥ kuçalena yudhyatā yathā haris tad daçādāivatarin tathā* (“was made ten-fold [cut into ten pieces] by the skillful warrior, like an oblation offered to ten divinities”).

Here *caturaḥ* is plainly *caturāñçāḥ* in sense, but as to the form, it is difficult to say whether by analogy with late compounds in *catura* it is nominative singular, or by analogy with “make one four” accusative plural, or by analogy with the cases above, nominative plural. I think it belongs to the last

group, “made-six-fold, made four.” The awkward sentence means as a whole that the six parts of the elephant and the four parts of the king were like an oblation cut into ten parts.¹

Saptan. By analogy with the cases already mentioned it may be suspected that *sapta* stands for *saptasu* in xii. 343. 106, where Kāndarīka is said to have arrived at Yoga-perfection because of his excellence, *mukhyatvād*, “reflecting often on the sorrow caused by birth and death, *saptajātīṣu*.” The commentator says “the sorrow of seven births,” *sāptajanmikam*, which would imply “in seven births,” and not the compound “among those having seven births,” which is the natural interpretation. As to the meaning, it is probably the indefinite sense of “many,” which in most examples is hard to verify (i. e. to show that ‘seven’ is used without any reference to a fixed number). For in “seven paces,” “seven flames,” “seven seers” and “seven rivers,” seven, for all we know, may have been intended literally. There are two cases, however, where *saptan* clearly means “many” simply; once where, instead of elephants *tridhā prasravantah* (an oft-repeated phrase), we find *saptadhā*; for the parallel *sarvatah* is used in the same way:

- i. 151. 4, *trihprasrutamadah*,
- vi. 64. 58, *tridhā rājan prasravanto madam bahu*,
- vii. 26. 6, *kṣarantaḥ sarvato madam*,
- vi. 95. 33, *saptadhā sravatā madam, parvatena yathā toyāṁ sravamāṇena sarvaçah*.

The second case is where *bhuvanāni viçvā* interchanges with *bhuvanāni sapta*, or, in the gender of the later epic, *bhuvanāḥ sapta* (see hereafter).

Aṣṭā. The final vowel is short or long according to metrical convenience, long when the length is indifferent:

- iii. 102. 3, *açūtiḥ çatam aṣṭāu ca nava cā 'nye*,
- aṣṭāu* required by the meter;
- vii. 146. 134, *akṣāuhinīr aṣṭā hatvā*,
- aṣṭā* required by the meter;

¹ The *havis* called *daçadāivatam*, represented here by *daçāñça* (the man and elephant together) “in ten parts,” is called *daçāñço homah* in xviii. 6. 105.

xiii. 111. 69, *bhūtvā mīnō 'ṣṭa varṣāṇi*, also required.
 v. 86. 9, *daṇḍa 'ṣṭa ca*, and vii. 82. 8. and 16, *çatam aṣṭa ca*,
 cases of diiambus, brevis required;

ix. 46. 74, *mahiṣāṁ cā 'ṣṭabhiḥ padmāih*,
 short vowel required;

viii. 22. 6, *aṣṭābhīr api, Bhārata*,
 long vowel required; ib. 17, *Nakulāya çatāny aṣṭāu*, indifferent.

Respecting the alleged difference between *aṣṭāgava* and *aṣṭāgava*, PW. i. 531, there are two verses, one of which is

viii. 67. 6, *aṣṭāgavāṁ aṣṭa çatāni bāñān* (sc. *vahanti*),
 which Nilakantha interprets as “eight eight-cow wagons carry
 hundreds of arrows,” his *teṣāṁ aṣṭāgavāṁ* implying a short
 genitive modelled on *gavāṁ* (*aṣṭāu gāvō yasmiṁs tad aṣṭāga-*
vāṁ çakatāṁ teṣāṁ aṣṭāgavāṁ aṣṭa aṣṭasāṁkhyāni çakatāni,
nudabhāva ārsah, çatāni bāñān anekaçatasāṁkhyān vahanti).
 One is tempted to read *aṣṭāgavāny*, as in the next passage,
 which, however, has the short vowel:

viii. 20. 30, *aṣṭāv aṣṭagavāny ūhuḥ çakatāni yad āyudham*
ahnas tad aṣṭabhāgena Drāunīç cikṣepa, māriṣa,

“Drona’s son, Sir, threw as many missiles in an eighth of a day
 as eight eight-cow wagons carry,” which repeats with elaborate
 definiteness the statement of the preceding verse that the hero
 poured arrows as Pūṣan’s “younger brother,” Pūṣanuja, that is
 Parjanya, pours rain. The scene is late and instructive for the
 critique of the epic. The hero here particularly lauded is a cer-
 tain Pāṇḍya, quite unnoticed previously but now extolled as the
 ablest warrior on the Pāṇḍu side. It is he who, as explained
 above, is quartered and made with his elephant a ten-fold obla-
 tion. There appears to be no grammatical difference between
aṣṭāgava and *aṣṭagava*.¹

In regard to *aṣṭacakra*, the Petersburg lexicon gives only the
 Vedic *aṣṭacakra*, but *aṣṭacakra* is found (of Hari’s wagon,
yāna) in vi. 8. 16; xii. 335. 11; and (of a demon’s car, *ratha*)

¹ Compare for these compounds, *hastiṣadgava*, viii. 38. 7, of a war-
 car, and *saṅgavīyāṁ çakatām*, ib. 76. 17. In xii. 37. 32, sixteen cows
 are yoked to a war-car.

in vii. 156. 61; 167. 38; 175. 13; and (of an *açani*) in vii. 175. 96. In the first three Droṇa cases, *samāyukta* is added, a set formula. In the first case, from Bhīṣma, the word also begins a *pathyā* and the whole verse is repeated in the next Çānti case, *aṣṭacakram hi tad yānam bhūtayaktam manoramam*. As the last case, too, stands at the head of a *pathyā* and in this situation *aṣṭacakram* would be metrical, the choice must be due to preference for the later form.

Nava. The Vedic phrase *jaghāna navatīr nava* I have already, *Journal*, vol. xxii. p. 389, located in the epic, ii. 24. 19. To this example should be added also the same phrase occurring at ix. 51. 36 and xii. 22. 11. The last is farthest removed in context from the original, while the passage in Çalya gives the Vedic text very closely in making the weapon the bones of Dadhica (epic form):

- RV. i. 84. 13, *Indro Dadhico astabhir vr̄trāny apratiṣkutah jaghāna navatīr nava,*
 Mhb. ii. 24. 19, *yena (rathena) Çakro dānavānām jaghāna navatīr nava,*
 ib. ix. 51. 36, (*Dadhīca, tasyā 'stibhīḥ*) *dāityadānavavīrānām jaghāna navatīr nava,*
 ib. xii. 22. 11, (“*Indra the son of Brahman became a Kṣatriya by his acts and*”) *jñātīnām pāpavṛttinām jaghāna navatīr nava.*

In each case (but the first is not annotated) Nilakanṭha says that the number is (not ninety-nine but) eight hundred and ten (nine nineties). In i. 32. 24, *navatyā navatīḥ (kr̄tvā)*, v. 1. *navatyo*, the multiplication is definite, 8100.

To the forms recognized in grammars and lexicons I am tempted to add *navāīḥ* as instrumental plural. Otherwise we must assume that *new arrows* are especially used when their number is ninety, whereas generally there is a natural predilection for such conjuncts as six and sixty, seven and seventy, and nine and ninety. So by analogy with *navatyā navabhiç ca* in viii. 30. 25 we find *navāīr navatyā ca çarāīḥ* in viii. 90. 60. At the same time, “nine” and “new,” owing to their like sound, are found together, as in viii. 48, 50, *navāīr navabhir āyasāīḥ*, but in the case above *ca* seems to show that *navāīḥ* is a numeral.

I would remark, by the way, on the partially formulaic character of most of the shooting in the battle-scenes. The test of an archer's skill is not only to shoot one arrow well but to shoot many arrows at once. Among digits the object shot at determines, for the main part, the number of arrows used. With four arrows one shoots the four steeds; with three, the arms and forehead or the three charioteers, etc. But even here there is an occasional irruption of eights, the favorite number of the later epic. Thus in viii. 89. 63, ten and eight; 65, eight; 68, eight hundred and eight thousand; 76, eight; all in a bunch, though up to this passage the whole preceding eighty odd sections show only half a dozen cases. So in the late wonder-tales of the first book, larger numbers are by preference expressed in terms of eight or its multiples, e. g., i. 100. 20, to express thirty-six years, "years sixteen and eight and also four and eight more." I shall have occasion in a later section of this paper to show how this Buddhistic number has driven out the more ancient holiness of nine.

In the "down-pour" of arrows said to be shot by decades there is a certain preference for stereotyped groups. Twelve, fourteen, fifteen, and sixteen are shot more often than seventeen and eighteen. Twenty-one, *trisaptan*, is a favorite for the same reason that endears *trisaptati*, as three and seven(ty) are sacrosanct numbers. In this decade, twenty-five is also a favorite, while twenty-seven is the rarest; in the third decade, thirty-six is the conventional number, with a few cases of thirty and thirty-two. The fourth decade is almost ignored; the fifth appears rarely as fifty; then come sixty and six and sixty (less common are three and four and sixty); seventy and seven and seventy (less common are two and three and seventy); eighty (rare); ninety (nine and ninety as above); and occasionally one hundred, three hundred, five hundred, and even ten thousand arrows all discharged from one bow at one shot!

Daça. The *dāçatā* of vi. 2,700 (rightly condemned in PW.) is replaced in B. 61. 21, by *triñçatā*. The epic has *daçati*, analogous to *saptati*, *navati*, not as decade but as one hundred (as who should say "ninety, tenty"), the form, however, being formulaic like *navatīr nava* (above), and probably a new formation, as it occurs only in the later part of the epic. The decisive cases as regards the meaning are (i. 16. 8-13 and) v. 108. 14, the latter:

Omkārasyā 'tha jāyante srtayo daçatir daça,

where a “thousand branches” is Nilakantha’s undoubtedly correct interpretation. In xiii. 30. 21, the ten might be decades or hundreds (of days), though here also Nilakantha admits only the latter and says the word is *Analogie-Bildung*.¹

Holtzmann, *op. cit.*, § 483, has spoken of *saptadaçesu* at iii. 268. 11. I think Nilakantha’s explanation (having eight royal acts and nine *siddhis* and *caktis*) is quite inadmissible. Families “having seventeen” would be more likely to be thought sinful than virtuous. Compare the “seventeen fools and sinners” of v. 37. 1–6. Then in v. 36. 22, the “great families” are defined as those which *ete saptaguṇa vasanti*, “seven virtues” being their possession, which suggests *saptagunesu* as the right reading. But here the meter alone is enough to change *saptadaçasu* to *saptadaçesu* (*vayam punah saptadaçesu Kṛṣṇe kulesu sarve 'navameṣu jātāḥ*).

Higher numbers. Nineteen is not *navadaça* in the epic but, as in Latin *undeviginti*, *ekonaviñçati*.² In xiii. 107. 87, *ekonaviñçat* serves as an ordinal, *ekonaviñçati dīne* standing parallel to *śodacea*, *saptadaçame*, *aṣṭādaçē*, and *pūrñe viñçē* (*divase*). At C. xi. 561, *pariviñçat* offers a form parallel to *triñçat* (also *triñçati*); but B. 19. 15 has *pacya Kṛṣṇa* for *pariviñçat* (*Vivinçatim*). In i. 2. 330, B. has *viñçat*, C., *triñçat*; ib. 379, *viñçac chlokaçatāni*. The late Rāmāyaṇa also admits *viñçat* in *ekaviñçat* (ref. PW.). The epic accusative of the following decades is frequently identical with the nominative; for example, in i. 86. 15, *abhaṅṣah ḡaradas triñçat*, either form doing duty for either case. Examples of *triñçat* and *pañcāçat*, as accusatives of object and duration respectively, are given below, and in xiii. 168. 5 and 27, respectively, *pañcāçat* is accusative, *çarvarīḥ pañcāçat*, and *pañcāçatam* is nominative, *aṣṭapañcāçatam rātryaḥ çayānasyā 'dya me gatāḥ*, as in the further case cited below. The corresponding ordinals in the text (the *adhyāyas* are counted by *-tama* forms as well) are short, *ekaviñça*, *dvāviñça*, *trayoviñça*, *caturviñça*, *pañcaviñça*, *ṣaḍviñça*, *saptaviñça*, *aṣṭaviñça*, *ekonatriñça* (compare *ekonasasti*, *ekonasaptati*, i. 2. 204, 289, etc.), xiii. 107. 93–121.

¹ For thousand the later epic uses *daçatam*: *tathe 'śṭināṁ daçatam prāpnuvanti*, xiii. 102. 86, etc. (meter, *Great Epic*, p. 305).

² Or *viñçatir ekonā*, vi. 4. 15.

Before leaving this subject I would say a few words on certain declined forms of *eka*, not because they are irregular as forms, but on account of the way they are used. The first point is the parallelism between the adverbial ablative and the instrumental, as shown in

v. 43. 21, *tribhir dvābhyaṁ ekato vā 'rthito yah.*

According to the commentator, *arthita* here means possessed of or furnished with, *artha*, a meaning not usually recognized, but in accordance with the sense of the passage, which says that one who has in his power all the twelve virtues is fit to rule the earth, while “he that is furnished with three, two, or one,” is to be known as one having wealth, *tasya svam astīti sa veditavyah*. In any case, *ekatah* is used freely here as a correlative of the instrumental.¹

The same form has a meaning almost recognized in the Pet. lexicon, which ascribes to it, besides the ablative sense and that of “on the one hand,” the meaning of “together,” or “in one.” By a slight extension of meaning *ekatah* means altogether, solely, or, quite literally, one-ly, only, as in vi. 107. 20,

*yathā prajvalitam vahnim pataṅgah samabhidravan
ekato mṛtyum abhyeti tathā 'ham Bhīṣmam īyivān,*

“As an insect entering a blazing fire meets only with death, so I, on having encountered Bhīṣma.” This, at least, is Nīlakantha’s exposition, who takes the word as equivalent to (*ekau*) *kevalam*, *mṛtyum eva*, rather than as contrasting the insect “on the one hand” with the speaker. The plural *eke* meaning “alone” may be used as well as the singular, *nāi 'ke 'gnanti susampannam*, “eat dainties alone,” xii. 228. 44.

Examples of the correlation by two *ekatah* are not uncommon. One is found in

xii. 12. 12, *ekatac ca trayo rājan grhasthācrama ekatah,*

where against the other three orders is weighed that of the householder, which is said to be equal to all the others put together.

¹ For the usual meaning if applied here would be “he who on the one hand is furnished with three or two.” Compare the parallel use of *prathamataḥ* in xii. 82. 1, *esā prathamato vṛttir dvitiyām ḡṛṇu*, *Bhārata*.

In the following stanza I think we may see an extension of Vedic usage surviving in the epic:

xii. 21. 7, *anye sāma praçānsanti vyāyāmam apare janāḥ nāī'kam na cā 'pare kecid ubhayam ca tathā 'pare.*

The commentator admits the double negative as an affirmative and according to him the stanza would mean: "Some praise mildness, others praise a strenuous life, still others praise the one (Yoga-discipline, *dhyāna*), and others again praise both." But, although the affirmative double negative is not an impossibility, it carries with it a strength of affirmation¹ that is quite uncalled for in this passage, where *ekam* certainly has no right to be represented by *dhyānam*. In the continuation it is said that some sit in quiet meditation, some are active in governing, and others are *ekāntayilināḥ*, which may have led the commentator here to set up a third object of devotion. But with the antithesis of *ubhayam* there can be no doubt that *ekam* is one of the two already mentioned, and the meaning to be expected is that some praise mildness, some praise energy, some praise neither, and some praise both; which, in my opinion, is what the passage was intended to mean when it was first written. In other words, for *nāī'kam na ca*, we should read *nāī'kam ca na*, which preserved the old phrase found in BAU. vi. 2. 2, *nāī'ham ata ekam ca na veda*; ib. 3, *tato nāī'kam ca na veda*. Otherwise *na ca na* survives only in indefinites, *na katham ca na*, etc. The sense of *nāī'kam* as "many a" is here excluded. This latter meaning is common, e. g., *nāī'kam yugaviparyayam (avasam)*, "many an age," xii. 229. 49.²

¹ It is used, however, generally, where two clauses are distinguished, e. g., *na cāī'va na na prayuñjīta, saṅkirṇam parivarjayet*, "not that one should not commit (these faults, but) one should avoid excess," xii. 56. 42; or in strong affirmation, *na sa yajño na bhavitā*, i. 38. 2, "it will surely occur;" *nahi tvāṁ no 'tsahe hantum*, xii. 227. 80, "assuredly I can kill thee." Compare the parallel in the same scene (repeated) in xii. 224. 38, *evaṁ nāī'va na cet kālah . . . pātayeyam ahaṁ tvā 'dyā*, "I could kill you now; if it were not so, if Time did not (prevent)." Compare xii. 239. 4-6, ending *etad evaṁ ca nāī'vaṁ ca na co 'bhe nāī' nubhe tathā.*

² In xiv. 49, a similar but longer string of opinions is given by *kecit, anye, apare*, and *eke*, indifferently, ending with cl. 12, *sarvam eke praçānsanti na sarvam iti cā 'pare*, "some praise everything and others nothing."

In regard to the choice between *eka* or *ekatara*, the epic uses either, as in xii. 81. 9, *vṛṇomy ekataram na ca*; 10, *ekasya jayam ācañse*, ("like the mother of two gamblers) I prefer neither, hope for victory of the one." In i. 119. 15, *vāsyāi 'kam takṣato bāhuṁ candanenāi 'kam ukṣataḥ nā 'kalyāṇam na kalyāṇam cintayann ubhayos tayoḥ*, "not thinking ill or good to appertain to [these both] either of these, him cutting one arm with an axe and him anointing one with sandal-paste" (for *anyataram*). In triads, one, another, and a third, *anya, apara, para*; *eka, apara, eka*, and so forth, xii. 86. 30; 137. 4. Though *katara* is used quite regularly, *kim* may take its place, as in xii. 126. 16, where, after two are mentioned, we find *kim nu jyāyastaram*, "which (of these two) is more greater?" So *katama* and *ka*, xii. 167. 2.

On the form of other epic numbers I may refer to what has already been given in the Petersburg lexicon and in Professor Speyer's *Sanskrit Syntax*. I will only register another *pañcācatam* (*guṇāḥ proktāḥ*) for *pañcācat*, xii. 256. 8, and observe that *dvisaptati* appears in Manu, vii. 157, but epic *dvāsaptati* (in the same passage) at xii. 59. 71; at the same time remarking as to *çatā* for *çatāni*, in iii. 67. 6, where C. has *çatam* *çatāḥ*, that masculine *çata* belongs to the more recent parts of the epic, whence *çatā*, like *viçvā*, may have been the original. As to the feminines, *triçatā*, etc., which have been noticed by Speyer, *op. cit.*, § 294, these forms are also late in the epic, *triçatā* and *saptaçatā* (i. 2. 324) and cognate forms are found in still later works. Further: besides *daçaçatam*, above (and *daçasāhasram*), "a ten-hundred," there is the uncommon uncompounded singular form (as if plural), as in xiii. 112. 14–15, where, parallel to *daçaçatam vedavidām* (in cl. 28), appears *brāhmaṇānām çatam daça*.

The question as regards appositional construction may be discussed here though it pertains to syntax rather than to form. All substantive numerals may take this construction, *sahasram parivatsarān*, i. 94. 41, etc., which is not irregular if we understand "years, a thousand," rather than "thousand (of) years." But with the higher numbers the noun is usually either compounded, *varṣāyutāni*, etc., or is in the genitive, *puruṣame-dhānām ayutam*, i. 95. 20.

The particular example just given has indeed a sort of stereotyped form, especially when “eleven thousand years” are referred to. As one says *bahuvarsagañān*, “many year-rows,” e. g. xiii. 111. 98, so one says year-hundreds or thousands, *pañcavarsaçata*, etc., and uses a formula with eleven, ten thousand and ten hundred: *daça varṣasahasrāñi daça varṣaçatāni ca*, iii. 12. 12; *daça kalpāyutāni*, ib. 200. 121. A modifying number is placed in the same construction, as a general thing, *ayutāni pañcācat* (accusative) with genitive, xiii. 107. 31; *yuddham varṣasahasrāñi dvātriñcat abhavat kila*, “the war (of the gods and their elder brothers, the devils) lasted thirty-two year-thousands,” xii. 33. 26. But here also a genitive is often found (more correct), *dve yugānām sahasre*, xiii. 107. 113, etc., and an inverted order, as in *çatavarṣa*, not as adjective but noun, is permitted, *vāyasaḥ çatavarṣāni (jivati)*, xiii. 111. 86 (compare *çataçāradam*), in this instance due, perhaps, to the meter (to avoid a third *vipulā* after a trochee), but found also ib. 118, *kṛmir viñçativarṣāni*. The very unusual construction found in i. 90. 1 is probably due to meter also. Here we have *samvat-sarānām ayutāni çatānām*, “a ten-thousand of hundred years.” Close by occurs another case of apposition, i. 93. 24, *tadā 'dadām gāh çatam arbudāni*, “then I gave cows, a hundred hundred-millions.”

An adjective may or may not agree with the implied genitive; both together, for example, in iii. 127. 2 and 13, *bhāryāçatañi sadṛçinām* and *sadṛçam*. Possessives, by the way, put the numeral either first or last, with possessive ending, *daçagu*, *sahasragu*, *goçatin*, xiii. 78. 11. Compare with the last, ib. 102. 43, *yo gosahasrī çatadah samām samām, gavām çatī dadyāc ea*.

In regard to the syntax of decades, both genitive and apposition are common, and, beginning with *viñçati*, we find, for example, *saṁśārān viñçatim*, xiii. 111. 117; *triñcad agnūn (ayajam)*, xiii. 103. 36. An interesting case historically is found in xii. 335. 35–37, *ekaviñçatir utpannās te prajāpatayah smṛtāḥ*, not only because “twenty-one Prajāpatis” are late-epic, but because in the twenty names given as those of the sons of Nārāyaṇa one has been left out, the list being Brahman, Sthānu, Manu, Dakṣa, Bhṛgu, Dharma, Yama, Marici, Aṅgiras, Atri, Pulastya, Pulaha, Kratu, Vasiṣṭha, Parameṣṭhin, Vivasvat, Soma, Kardama, Krodha, Vikṛīta.

The singular noun (an unusual case, compare Speyer, *S. Syntax*, § 294) occurs with *triñcat* in xiii. 101. 15, *narakam triñçatam prāpya* (v. l. in C.). The plural decade also is found in the later epic, e. g. *triñcato 'bdān*, xiii. 103. 34.

The word *viñçati* gives the name *Viviñçati*, a hero whose foregone fate is to be attacked with twenty arrows, in a repeated phrase: *Viviñçatim ca viñçatyā virathām krtavān prabhuh*, vi. 117. 44=vii. 14. 27, etc. Such number-names are not confined to this hero and the three wise men, Ekata, Dvita, Trita, as they are found also in the satyrs' names, Aṣṭaka and Navaka, Skanda's goat-faced sons, iii. 228. 12; and in xiv. 4. 5 are mentioned Ikṣvāku's descendants *Viñça* and *Viviñça*, who are unknown to the early epic but appear in the Purānic literature and the pseudo-epic so clearly associated with it.

An ordinal may be employed to take the place of a cardinal prefixed to another cardinal, as in i. 95. 37, *caturviñçam putraçatam babbūva*, "a twenty-fourth son-century was born," that is one hundred plus twenty-four, which leads eventually to *caturviñça* being used for *caturviñçati* as in *caturviñçākṣarā* for the Gāyatrī in the Harivañça (v. PW.), a meaning that may belong to the passage above as well.

The ordinal may (but does not generally) agree with distributed singulars, although combined with one, as in the verse of ii. 77. 31 repeated at xiii. 148. 61, *Duryodhanasya Karṇasya Çakuneç ca . . . Duḥçāsanacaturthānām bhūmih pāsyati çonitam*. The ordinal in such a phrase as "five went and she too (as) sixth" needs no comment, and almost as common is such a turn as "they five set out having her (as) sixth;" but "with self as" is probably a late locution, though like the Greek idiom. It is found in (xiii. 177. 52, *ātmanā saptamam kāmanī hatvā*) the same passage from which examples of these constructions may be taken, namely, "seventh with himself (instrumental) went the king," xvii. 1. 23–25, *prasthitān Drāupadīsañthān . . . bhrātarah pañca Kṛṣṇā ca sañthī cvā cāi 'va saptamah*, followed by *ātmanā saptamo rājā niryayāu Gajasāhvayāt* (late addition to Pāṇini, vi. 3. 6, PW. Rām. examples). As *ātman*, plural reflexive in singular, is not very fully illustrated in PW., I will add *nāthavantam ivā 'tmānam menire*, "they regarded themselves as having a savior," i. 183. 10.

The word *dvitīya*, “second,” passes in compounds from the meaning “having as second” to that of “with,” and independently to that of alter (ego), i. e., a friend. Familiar examples are those given by Speyer, *chāyādvitīya*, “(doubled) with his shadow,” *asidvitīya* “seconded by his sword.” An example of the personal construction is *Yuyudhānadvitīya*, “along with Y.,” xiv. 66. 11¹ (compare *dvitīyavat*, with instrumental, iii. 313. 47); *me dvitīyah*, “my friend,” xiii. 102. 57. The idiom, though perhaps not new, is not often used,—generally in late passages. Another case occurs in v. 50. 26, *Kṛṣṇadvitīyah*, a passage not removed from the suspicion of being a late adornment.

The second ordinal answers to our “another” in such phrases as *dvitīyasāgaranibha*, “like another ocean;” while the “same” is expressed by the first cardinal: *ekaduhkhāḥ prthaksukhāḥ*, “having the same sorrows but separate pleasures,” i. 10. 4 and 50; *ekārtha, ekabhojana*, “having the same aim, food,” etc.²

Ordinals are occasionally used to indicate time. First in time, as contrasted with a subsequent event, is, indeed, generally given by *pūrvā*, “former,” *pūrvarūpāni*, “preliminary symptoms,” xii. 228. 1; or *purastāt*, “previously,” i. 189. 22; but *prathama* is used in the same way, *prathamam . . . paçcāt*, “at first and afterwards,” xii. 227. 68, etc. A “second time” is *dvitīyam*, iii. 60. 7; *dvīḥ pūrvam idam tṛtīyam*, “twice before and now for the third time,” iii. 92. 9; *pūrvam . . . punah . . . idam tṛtīyam*, “first, then again, and now for the third time,” xviii. 3. 35; often as adj., *esā tṛtīyā jijñāsa tava kṛtā*, “this is the third examination you have taken,” ib. 32.

Before passing on to the epic methods of indicating arithmetical processes in detail, I may remark that with the exception of time (and religious observances),³ where the duodecimal sys-

¹ The next stanza, xiv. 66. 12, has a form not recognized in the lexicon, *pitrsvasām*, as compared with the regular *pitrsvasāram*, the latter found in v. 90. 1; viii. 87. 16; xiv. 52. 53. Another late passage, vi. 116. 3, has *svasām* (like *duhitām* in *Virāṭa*; the last noticed by Holtzmann, *Anhang*, § 371).

² Occasionally ambiguous. Thus, *ekapatnītā* is the condition of having “the same wife”; but in R. v. 28. 13, *ekapatnītvam* is having “only one wife.” But the context makes the meaning clear.

³ The expansion is rather wide on this side and varies between time-divisions (twelve years of fasting, sacrificing, etc.) and religious numbers, for example, the twelve syllables of the *pāda* of the *jagati* verse, iii. 134. 19 (observe *navākṣarā bṛhatī*, ib. 16).

tem, 12, (30) 60, etc., is naturally selected, the decimal system is in ordinary use, both for the system of administration, xii. 87. 1 ff., and for the army, ib. 100. 31, etc. But it does not appear in any system of measures and only once is used of weights, though it should be added that the indications of values are so rare as to be of little importance (in iii. 134. 15, *aṣṭāu ḡanāḥ ḡatamānāṁ vahanti*; also *drauṇika*, ref. PW.).

COUNTING AND ADDITION.

Except in counting up money, *sampīdayati*, and a poetical use of *yuj* and *yoga* (*navāi 'va yogo gaṇanāme 'ti ḡaṣvat*, of the nine digits in counting, iii. 134. 16; *tam muhūrtam kṣāṇāṁ velāṁ divasāṁ ca yuyoja ha*, “she reckoned the time,” ib. 296. 7), the usual word for count (counting is *gaṇanā*) is (*pra*)¹ *gaṇayati*, as in iii. 193. 28, *yatrā 'hāni na ganyante*, “where days are not counted;” *saṅgaṇanā nā 'sti*, “there’s no counting,” xiv. 73. 24; *gaṇayasva*, “count,” iii. 72. 23; a word that passes into the sense of reckon, think, especially with *vi*, and regard, *na ca tān gaṇayām āsuḥ*, “disregarded them,” viii. 37. 10 (*gaṇaye* in R. vii. 16. 42 appears as *gane*, *mānuṣān na gane*, “I don’t regard men”). Often follows the object compared in the instrumental, *na gaṇayāmy etāns tṛṇenā 'pi*, “I do not care a straw for them,” ii. 44. 34. Though *gaṇeya* is used, yet the corresponding adjective, calculable, is usually *parimeya* or *saṃkhyeya*, *saṅkhya*, i. 74. 33; iii. 121. 11, etc.; i. 55. 2, *caṅkrasya yajñāḥ ḡatasāṅkhya uktāḥ*; xiii. 107. 36, *saṅkhyā ati-guṇā*, “incalculable number.” The idea of addition is given both by simple juxtaposition, usually prefixing, of cardinal or even ordinal (above) numbers, whereby it is sometimes doubtful whether, as in *daṇḍaṭam*, the modification is by addition or by multiplication; and by *adlikam*, as in *ekā ḡatādlikā* (i. 115. 21 and 41, *ekādhikaṭam pūrṇam*, *ṭatam pañcādlikam*, or prefixed); that of completeness, by *pūrṇa*, full, *sāgra*, all, and *api* and *pari*. Only the last requires a word.² The native scho-

¹ *tataḥ pragaṇayām āsuḥ kasya vāro 'dyā*, “they calculated whose turn it was,” i. 164. 14.

² For *pūrṇa*: “they say that ten hundreds are a full, *pūrṇa*, thousand,” iii. 134. 17. For *sāgra*: *ṭatam sāgram*, “a whole hundred,” xii. 112. 6; R. G. v. 7. 28; for *api*: “still be to thee even (full) ninety-nine sons, but abandon this one,” *ṭatam ekonam apy astu putrānām, tyajāi 'nam ekam*, i. 115. 37.

liast gives to *pari* not the sense of completeness but of addition. Unfortunately he does not recognize the reading *parivinçat*, given above, but he renders *paricaturdaça* by fifteen at iii. 1. 11 and iii. 93. 28, and at ii. 3. 37 by “fourteen over” (more). On *parisodaça*, at iii. 78. 2, he says nothing. Completeness would seem to be the real meaning by analogy with *parisamvatsara*, for example in iii. 108. 13 ff., *sahasraparivatsarān . . . samvatsarasahasre tu gate divye*.

Less common is the use of *uttara*. In i. 128. 18, *çatam ekottaram tesām*, “a hundred of them with one more.” So in iii. 308. 1, *daçottara* in the phrase *cukle daçottare pakṣe*, “on the eleventh bright half-month” (after ten full months). This accords not only with the scholiast’s explanation but also with the usual allotment of ten (whole) months of pregnancy. Other examples of *uttara* as plus will be found correctly given in the Petersburg lexicon. Colloquial is *kim uttaram*, “what more?”; “not to have *uttaram*” is to be unable to reply to a remark. Another word for “more” is *ürdhvam*, over, beyond, with ablative. An adjective with *paras* or *param* also does duty for “more”: *pādarakṣān parahçatān* “beyond a hundred guards,” vi. 95. 36; *paramasahasrā viprāḥ*, “over a thousand priests,” xii. 38. 24; as *para* itself is used, *ekaç cā 'pi çatāt paraḥ*, “one more than a hundred,” i. 115. 1; *saṁvatsaraparāḥ kṣapāḥ*, “more than a year (of) nights,” i. 221. 13 (viii. 90. 61; 78. 55, *parahçata* and *parainçata* have already been cited by Professor Holtzmann, *Zur Geschichte*, i. p. 161. Examples are not numerous). Nilakantha follows an improbable tradition in attributing the meaning of “more” to *nis* in *nistrīñča*, (a sword) “more than thirty” thumbs in length, *triñcadañgulādhikāḥ*, iv. 42. 16, and elsewhere.

The word, *adhika* or *abhyadhika*, is used to convey a comparative notion, “more than,” *dīrghebhyaç ca manusyebhyah pramāṇād adhiko bhūvi*, “greater in size even than tall men,” xiii. 160. 15; which leads to the sense “superior to,” *lāghave sāuṣṭaveśu sarveśām abhyadhikāḥ*, i. 132. 15, and even to that of “more happy.” The ablative usually follows. Examples:

viii. 35. 4, *īçvarād adhikāḥ*, (Brahman) “greater than Çiva.”

vii. 74. 25, *yogāt tvatto 'dhiko 'rjunāḥ*, “superior to you through practice.”

viii. 32. 61, *Karno hy abhyadhikāḥ Pārthāt*, the same.

viii. 83. 31, *abhyadhiko rasah*, “a better taste.”

iii. 92. 15, *ko nāmā 'bhyadhikas tataḥ*, “more blessed (superior, better off) than he.”

So (*abhy*) *adhikam* is used as the comparative-maker of adjectives: *Somo Rohinyām abhyadhikam prītimān bhūtaḥ*, “Soma was more in love with Rohinī,” xii. 343. 57; *sā 'dhikām cōbhā-mānā*, “she was more lovely,” i. 221. 20. But *adhika* may mean “too great,” as in the only defect of Arjuna: *pindīkī 'syā 'dhike*, xiv. 87. 8 (his cheekbones were too prominent).¹

SUBTRACTION.

The farmer’s crop which is *ṣadbhāgaparicuddha* is “cleared” of the royal tax, that is, the sixth part of it has been subtracted, xiii. 112. 19. The usual term to indicate that one number has been subtracted from another is *ūna*, lacking, deficient, *pañco-nāmā catam*, “a hundred less five,” iii. 72. 11. The independent use of this word is rare: *ūne dvīyojane gatvā*, “two incomplete leagues” (not quite two), ix. 5. 50. Nilakantha recognizes the meaning of *nyūna*, the usual word for almost, in *avara*, which occurs in ii. 15. 22, *evam sarvān vāce cakre Jarāsandhāḥ catā-varān*, “he has overcome almost all a hundred,” after it has been said that the kings overcome were a hundred and one, and just before the more precise statement that they numbered eighty-six and that fourteen remained, *çeṣā rājanç caturdaça*, gl. 18 and 25, to complete the tale of one hundred. As one and a hundred means only a large number, *nyūna*, “not quite,” is supported by the context as the probable meaning of *avara*, and another passage also seems to show that this meaning, not recognized in the lexicon, which gives only “at least” with numbers, is possible. This is *na kaç cid aharat tatra sahasrāvaraṁ arhaṇam*, “no one brought as tribute there less than a thousand,” ii. 35. 11, literally “a tribute having a diminished thousand,” so that *avara*, “less,” forms the counterpart to *uttara*, “more.” The other meaning, from the idea of “less,” that of “at least,” is, however, the usual one, as in *mantriṇaḥ trya-*

¹ For “a half more than all” we have “all and more by” in xiii. 125. 10 (extension of Manu iv. 85); *ardhenāi 'tāni sarvāṇi nrpatiḥ kathyate 'dhikāḥ*. The scholiast says *adhikāḥ* is in antithesis to a little, *kṣudra*, king (equal to all these by a half is a great king).

varāh, “at least three,” xii. 83. 47. The “deficient” idea is common enough with nouns, for example, *guṇāvara*, “deficient in qualities,” and glides naturally into the combination with numbers. Another example of the rarer sense may, I think, be found in xii. 321. 158: *sa (rājā) tusyed daçabhāgena tatas tv anyo daçāvaraīh*, where “at least ten” scarcely makes the required antithesis of not even ten; for the sense seems to be that a very energetic warlike king “should be satisfied with a tenth and any other with still less.”¹ Opposed, by the way, to *avara* in the usual sense is *parama*. As shown above, *para* means “more;” but *parama* means “at most,” *sahasraparama*, “at most a thousand,” and this “most” is used for “whole,” *trivarsaparamosita*, of seeds kept to the highest point of three years, or, as we should say, three whole years, xiv. 91. 16.

The “remainder” is *çesam* or *gistam*, as in *pañcāçataṁ sat ca çesam dinānām tava jīvitasya*, “the remainder of thy life is fifty-six days,” xii. 51. 14; *çistam alpam nah*, “our life’s remnant is short;” *çeçev anyesu kāleṣu* “at other times, on remaining occasions,” i. 122. 26; *gese*, “as for the rest,” *agesatalah*, “wholly” (without remainder). The participle is more common than the noun, *varṣāṇi trīṇi çiṣṭāni*, “three years remain,” xv. 20. 32, and so often, especially with other participles, *hata-çiṣṭāḥ*, “those left from the killed,” still alive, xii. 54. 5, etc. The verb commonly used is *hiyate*, “is less” (*avaçisyate*, “remains,” *avaçistam=çistam*), opposed to *atiricyate* “is more;” *samībhavati*, “is equal” (equal in size is generally *samīmitam*); for “equal” as quit, the same word, *ubhayām tat samībhūtam*, “both sides are quit,” xii. 139. 24; equal, of scales, *tulā me sarvabhūteṣu samā tiṣṭhati* (*samo ‘ham sarvabhūteṣu*), xii. 263. 10. Compare xii. 176. 10:

*ākiimcanyām ca rājyām ca tulayā samatolayam
atyaricyata dāridryām rājyād api guṇādhikam,*

“I weighed in the scale poverty and kingship; poverty having more good qualities surpassed even kingship.” The measure is given by *pramāṇa*, either of size (as usual) or of number, as in

¹ Just before, the *daçavarga* is the group of imperial factors, but this does not seem to be referred to in this verse. The king, *sa*, is expressly *mahotsāha* and fond of military duties.

xiii. 107. 32, *lomnām pramāneṇa samam*,

sc. *rksacarmaçatasya*, (he is exalted in the Brahman world) “equally (as to years) with the number of hairs” (of a hundred bearskins). “Less” as inferior, secondary, is *gāuna* (see the next paragraph).

MULTIPLICATION.

While the word for times in its literal sense is (*-varam*) *kṛtvāḥ*, *pañcakṛtvāḥ* *tvayo* *'ktah*, i. 197. 49; *triḥsaptakṛtvāḥ*, passim, the verb for times, multiply, is *guṇay*, whence *guṇita*, multiplied by (the number preceding), literally “qualified.” In later texts, *guṇikṛta* is used in just the same way, but in the epic this word is, I think, used only in *dviguṇikṛtavikramah* (*Great Epic*, p. 419). In the same way, *guṇibhūta* is used in later texts for *guṇita*, multiplied, but in the epic it means inferior (compare *gāuna*), *guṇibhūtā* *gunāḥ sarve tiṣṭhanti hi parākrame*, “all qualities are qualified in (inferior to) valor,” ii. 16. 11. But usually no verb is needed to express multiplication, which as a formal arithmetical process the epic has as little occasion to make use of as subtraction. But the informal multiplication of ordinary language, double, thrice, a hundred-fold, without formal sums, is as common as in any other language, and the times thus indicated is regularly expressed either by simple juxtaposition of numbers, whereby, as has already been said, one is uncertain whether addition or multiplication is intended, as in *pañcaçatam*, one hundred and five or five hundred, iv. 43. 6 (only the syntax sometimes shows decidedly, *narāṇām pañcapañcāçad eṣā patti* *vidhīyate*, “a *patti* is reckoned as five [and] fifty men,” v. 155. 28); or by the noun *guna*, as in *satçirā dviguṇaçrotrah*, “having six heads and double as many ears,” iii. 225. 17; *ekāikam triguṇāih çarāih*, “each one (he wounded) with three times the number of arrows” (each had used), viii. 48. 70; *tataḥ ṣaṣṭigune kāle*, “in a time sixty times longer than that,” xiii. 28. 10. In this last case the same idea is expressed in the following stanzas without *guna*, but perhaps only because this word has been used several times already. Thus in 11, *tatas tu dvigate kāle labhate kāndapṛṣṭhatām*, “in a time two hundred (times longer) than that.” As an adverb: *tataḥ çatagunain duḥkham idam mām aspr̥çad bhr̥çam*, “this grief has afflicted me sorely, a hundred times worse than that,”

xi. 27. 33. In this use *guṇa* has ousted almost completely the old *vṛt* of *trivṛt*, which survives only in a few hereditary turns. A very uncommon equivalent is *sāṁkhyā*, as in xv. 3. 63, *yasya nāgasahasreṇa ḡatasāṁkhyena vāi balam*, “whose strength is comparable with a thousand elephants¹ a hundred times over” (numbered a hundred). Between the qualitative and temporal meaning, where the word is equivalent to *kṛtvah*, “times,” lies the application found in ii. 24. 6, where, in a wrestling-match, one is whirled about a hundred times, *catagunam*, a description, by the way, copied in many details by the writer of iv. 13, where §l. 36, for example, has the same expression. Here *dviguṇam* occurs in a physical sense also, *rakṣo dviguṇāṁ cakre*, “he doubled that demon up,” i. 163. 27 and elsewhere.

A combination of adding and multiplying, as in “more than so many times that” is expressed by the *guṇated* numeral (to use this word thus) plus the word for “more.” Thus, “he gave them wealth more than five times what they had asked him for” is *prādāc ca dravīṇam . . . yatho 'ktavantas te tas-miṁs tataḥ pañcaguṇādhikam*, ii. 12. 15. Without “more”: *yatho 'padiṣṭam ācāryāḥ kāryāḥ pañcaguṇo 'rathāḥ*, “let my chariot be furnished with five times (as many arrows) as the teachers enjoin,” vii. 112. 48; *yathā veda dviguṇāṁ vetsi*, “you know twice as much as he knows,” viii. 32. 62. Here partial correlation takes the place of the comparative (ablative) idea. The more elaborate construction is also common, as in xiii. 100. 7: *yathā ca gṛhiṇas toṣāḥ . . . tathā ḡataguṇā prītiḥ devatānām*, “a hundredfold so great is the joy of the divinities as is the satisfaction of the householder.”

Sometimes, when the completion of the clause is easily understood, it is left out entirely, and we find (of the *ahīna* sacrifice) *dakṣiṇāṁ triguṇāṁ kuru, tritvāṁ vrajatu*, “make the fee threefold, let it reach treble,” xiv. 88. 14, that is, make it three times more (than ordinary).

Some curiously awkward methods of multiplying are found. In i. 55. 2, after saying that Indra’s sacrifices are a hundred in

¹ So in using the ablative it is not necessary, any more than in Greek, to be precise in the application of the case following “times that;” *aṣvamedhād daṅguṇam phalam āhuh*, “they say the fruit is ten-fold (that of) a horse-sacrifice,” iii. 82. 27.

number, *samkhya*, the poet adds: "But your sacrifice here, O Bhārata, is *tathā param tulyasamkhyam cataṁ vāi*," which the scholiast explains as equal to an *ayuta* of Çakra's (100×100), but perhaps only another hundred is intended. In xiv. 65. 18, however, there is no escaping the awkwardness with which one number is multiplied into another of a separate category. What the poet wants to say is sixty thousand camels and twice as many hundred horses, which he expresses by "twice as many horses hundreds," *ṣaṭtir uṣtrasahasrāṇi çatāni dvigunā hayāḥ*. This is followed by *tāvad eva* with the plural noun, *çakatāni rathāc cāi'va tāvad eva karenavaḥ*, that is, "just as much" instead of "as many." So in iii. 281. 10-12, "fourteen crores of Piçācas, twice as much of Rakṣasas, *dvistāvat* (with genitive and with *koṭyāḥ* supplied), and three times as many Yakṣas," *tataḥ trigunā yaksāḥ*. Similarly, *yāvat tasya bhavet puṣṭis tejo* (etc.), *Kṛṣṇe tatrigunām*, "however much may be Arjuna's prosperity, glory, etc., Kṛṣṇa's is three times that," xiii. 148. 34. Ordinarily the numeral adjectives agree with the nouns compared, as in iii. 122. 27, *yāvantah pāvakāḥ proktāḥ somāś tāvanta eva tu*; vii. 201, 59, *ṣaṭtiṁ varṣasahasrāṇi tāvanty eva çatāni ca*. A connecting link is furnished by *tāvat* as part of a compound *yāvanti tasyā romāṇi tāvadyugasahasrāṇi*, iii. 200. 71, etc.

Another case of comparing numerically different sorts of things is found in vii. 65. 9, but here the number is the same: *vārkṣāc ca yūpā yāvantah . . . te tathāi'va punaç cā'nye tāvantah kāñcanā'bhan*.

Distribution is expressed by repetition, with or without an adverb: *navame navame 'hani . . . daçāhe vāi gate gate*, "each ninth day . . . as often as the tenth day passed," xiii. 107. 39, 43; *trayāṇām mithunāṇi sarvam ekāikasya pr̥thak pr̥thak*, "each one separately has two of the three," xiv. 18. 27. This relieves one of the necessity of distinguishing between each and all; for example, in xiv. 90. 34, *kudavām kudavām sarve vya-bhajanta*, "they all divided (so that each obtained) one *kudava*;" iii. 124. 21, *catasraç cā'yatā dañstrā yojanānāṁ çatāni çatam*, "four fangs extending a hundred leagues each." But *ekāika* is usually expressed, as above and in ii. 52. 21, *dat-tvāi'kāiko daçaçatān kuñjarān*, "each giving ten hundred elephants." The noun used alone may be singular, *jātam jātam*

ca sā putraṁ kṣipaty ambhasi, “she throws in the water (each) son when born,” or plural, *jātān jātān prakṣipā’smān (putrān)*, i. 98. 13 and 99. 43. The verb may agree with the singular: *ekāikas te tadā pāçāḥ kramaçāḥ parimokṣyate*, xii. 227. 116, perhaps only metrical, as in the same chapter *çocimi* for *çocāmi*, gl. 88. The late derivative *ekāikacyena* is found in xii. 326. 38, *tad antahpurakānanam suramyām darçayām āsur ekāikacyena* (here the grove opens out from the third *kakṣyā* of the palace).

With adjectives the cardinal stem prefixed multiplies the adjective, *caturbhadrataras¹ tvayā*, “four times as happy (compared) with you,” in vii. 55. 49. and xii. 29. 30, two scenes where all the “kings that died” are spoken of at length in two different but related accounts, of some value for the history of the epic.² In vii. 70. 25, the phrase is intensified: *caturbhadratarās tvayā bhadraçatādhikāḥ*.

Finally, there is the multiplication expressed by *dhā* as an ending, which gives not only the times of division and consequent multiplication of parts, and time literally, *ekadhā*, “at one time,” but also the multiple times in numbers, *saptadhā*, “seven times (over).” *Sapta tridhā* is thus equivalent to *sapta triguṇāni*. In xii. 223. 22, the Gandharvas dance *ṣat sahasrāni*

¹ The instrumental is not so very rare. Compare *eko hi bahubhiḥ çreyān*, “one (sage) better than many” (fools), iii. 99. 22; *ko nu svantataro mayā*, ix. 64. 21; *sā çā krçatārī mayā*, xii. 128. 14; *durmaraşanataras tvayā*, xii. 227. 81. The ablative is used after a positive, *mama balam bhīmaṁ vāyor api*, “my strength is greater than the wind,” xii. 155. 6. One case expresses comparison, the other the distance from, *sukhāt sukhatarām prāptah*, “coming from joy to more joy,” xiii. 119. 11. The ablative is found with only an implied comparison, *rājyād devatvam icchanti*, “they wish godship from kingship,” xii. 180. 20, leading to preference (*vṛye* and abl.; also *çreyān dāho na bhakṣanam*, i. 230. 21, etc.; Holtzmann, § 292 b). Noticeable is the double ablative showing clearly the construction’s origin, *svavīryād rājavīryāc ca sva, vīryam balavattaram*, “from (of) his own and a king’s, his own power is stronger,” xii. 165. 18. Holtzmann, at § 281, gives a few more examples of the instrumental. To the gen. comparat., my *Great Epic*, p. 473, add *maranām çobhanām (=varam) tasya*, i. 79. 13.

² The introduction of the former is in the latter put at the end of the account and the latter omits the second Rāma, which completes the list of sixteen in Drona. Bharata, too, changes places, being the ante-penultimate king in Çānti but the fifth in Drona, which has several later features.

saptadhā, literally in seven groups of six thousands, or seven times six thousand, that is, a not unusual amplification by a sacred multiple of an old group, for the Atharva Veda, xi. 5. 2, gives the same conventional *satsahasrāḥ*, though here three hundred thirty-three are added. The epic itself gives to the Gandharvas another conventional number at iii. 139. 6, where they are eighty-eight thousand in number and the Yakṣas are four times as many, *aṣṭāçītisahasrāṇi Gandharvāḥ . . . Yakṣāc cāi 'vā caturgunāḥ*. Another example is furnished by the list of Munis in seven groups of seven each, at xiii. 151. 42: *ity ete munayo divyā ekāikāḥ sapta saptadhā*, etc., “seven, one by one, reckoned sevenfold” (a different account in xiii. 166. 37 ff.). Compare also *saptadhā sapta saptasu*; *janma saptadhā*, xiv. 20. 23 and 27. The number of times a multiplied god appears is often expressed thus, as when Rudra, kind and terrible, one-eyed and three-eyed, appears as *ekadhā*, *dvidhā*, *bahudhā*, *cātadhā*, *sahasradhā*, *catasahasradhā*, xiii. 161. 43. One of his forms, by the way, is *dhūmra*, which gives, it is said, his name of *dhārjati(n)*, a title found only here, xiii. 162. 9, and vii. 202. 129, two passages of the same period and content, a late epic “Çatarudriya.”

DIVISION.

Halving is expressed by *dvāidhībhū* or *-kar* or *dvidhākar*; other divisions by *tridhā* (*trāidham*), *caturdhā*, and so on, with *kar* or *vibhaj*, e. g., *daçadhā kāryam̄ cesam*, “the remainder is to be divided tenfold;” *dvidhā krtā jihvāḥ*, (“therefore the snakes’) tongues were cloven,” i. 34. 23 (*dvijihvāç ca kṛtāḥ*, 24); *gavāṁ dvāidhīkṛtāḥ khurāḥ*, *khurān dvidhā 'karot*, “Rudra clove the hoofs of his bull and other cattle,” viii. 34. 105. The half, *ardha*, is used no more with nouns than with participles: *ardhāsanām labdhavān*, “he got half of Indra’s throne,” iii. 126. 38; *ardhacyutāsanāḥ*, “half flung from their seat,” vii. 196. 15; also of course with other numbers. With words of time, *ardha* follows or precedes in *māsārdha*, *ardhamāsa*, and means either the middle (of day or night, *ardhadivasa*, *-rātra*) or half: *ardharātrasamaye*, “at midnight” (so *passim*); *yady ardhadivasāni yudhyate*, “if he fights half a day,” vii. 190. 46 (*ardhadivasām gatvā*, “going half a day,” R. vii. 46. 24).

Besides *ardhamāsa*, “a month and a half” may of course be expressed in full. Thus, where *mā* is used exactly as in *mā ciram*, in iv. 21. 17, *mā dīrgham kṣama kālam tvam māsam ardham ca sammataṁ*, “have patience for a short time, a month and a half” (=*sārdha*).

The use of *ardha* with other numbers shows that, as in the case of two numbers joined and indicating that the former influences the latter without specifying how (e. g. *dacaçata*=110 or 1000), the prefixed *ardha* modifies the word with which it is connected, but does not specify whether by addition or subtraction or multiplication. So *ardhaçatam* is one hundred modified by one half, just as *ekaçatam* is one hundred modified by one, and the hearer is left to determine whether this means half a hundred or one hundred plus a half (hundred). With other fractions, however, there is understood a conventional modification of subtraction. Thus “half-fourth” is always (as adjective) three and a half, that is four as modified by a half. For example, up to two and a half *koss* is “to the half-third *koss*,” i. e. to the third *koss* as modified by a half, *kroçād ardhatṛtyāt*.¹

When not defined, *bhāga* and *añça*, “part,” mean a quarter, *caturbhāga=pāda*, a (fourth) part (of a quadruped). For three quarters is used either “three quarter parts” or “three parts.” The usual meaning of “three-part,” *tribhāga*, is one third, but it occurs also in the later epic (as in still later literature) in the meaning of three quarters. For other divisions, the part is made explicit, *açitibhāga*, $\frac{1}{8}$, etc. Only *kalā* is almost always $\frac{1}{16}$.

iii. 190. 10, (*krte catuspād dharmah*) *adharma-pāda-viddhas tu tribhir añcāih pratiṣṭhitāḥ*;

ib. 11 and 12, *tribhir añcāih caturthāñcena*.

In the pseudo-epic, the same situation is expressed by *pādono dharmah* (in Tretā), *dvipāda*, *pāda* (*adhare yuge*), to which is added the unique idea that even this quarter in Kali is so diminished as to leave one sixty-fourth, *bhavet kālaviçeṣena kalā dharmasya ṣodagi*, xii. 268. 33–34 (*caturthāñcena* also xii. 283. 51).

¹ The passage is cited in full on p. 147, below. I fail to understand Speyer's explanation, *S. Syntax*, § 301, that *ardhatṛtya* in such a case means “having the third being [but] half.”

- ii. 68. 78, *ardham harati vāi ḡreṣṭhah pādo bhavati kartrṣu.*
 iv. 52. 17, *balacaturbhāga*, “one fourth the army.”
 xii. 24. 12, *ādāya baliṣadbhāgam yo rāṣṭram nā'bhīrakṣati
pratigṛhṇāti tatpāpam caturañcena bhūmipāḥ.*
 ii. 5. 70,
*kaccid āyasya cā 'rdhena caturbhāgena vā punaḥ
pādabhāgāis tribhir vā 'pi vyayāḥ saṁcuddhyate tava,*
 “are your expenses covered by a half or a quarter, or
 at any rate by three quarters of your income?”
 vii. 186. 1,
tribhāgamātraçesāyāṁ rātryāṁ yuddham avartata,
 “the battle was renewed when one third the night was
 left.”
 vii. 191. 9,
tasya cā 'hnas tribhāgena kṣayāṁ jagmuḥ patattrināḥ,
 “in the course of one third of that day.”

The “third” may of course be expressed, as in xii. 285. 23, *labheta bhāgam . . . ardham tathā bhāgam atho tṛtīyam.* In xiii. 168. 28, *tribhāgaçesa* means “having three quarters left.”

In i. 96. 21 (as *ardhārdha* still later means a fourth) one eighth is expressed by “half a fourth,” *turīyārdham pradāsyāmo vīryasyāt'kāikaço vayam*, “we shall severally give a half of the fourth of our power,” said by the eight Vasus. It is rather remarkable that Kṛṣṇa is described in xii. 281. 62 as this fraction of God: *mūlasthāyi mahādevaḥ . . . tatsthāḥ srjati tān
bhāvān . . . turīyārdhena tasye 'mām viddhi Keçavam.*

When quarters are mentioned, as when Cṛī is quartered, *caturdhā vibhaktā*, and the quarters are enumerated, the first is *pāda* alone, the others are *dvitīya*, *tṛtīya*, *caturtha*, *pādas*, xiii. 225. 19 ff.

According to the commentator, *triguṇa*, threefold, like *tribhāga*, also means one third in v. 55. 66, where, after eleven armies have been contrasted with the seven which in comparison are called *nyūnāḥ*, “deficient,” the deficiency is declared to be great enough to warrant a battle, for

*balam trigunato hīnam yodhyam prāha Brhaspatih
parebhyas trigunā ce 'yam mama rājann anīkinī,*

whereto N. remarks that the adverb means (deficient) by a third, *tryañcena*, and the adjective “a third more.” And cer-

tainly if number is implied at all, eleven are not thrice seven but may be loosely reckoned as a group of three fours, deducting one of which would leave seven, so the “deficient” host would be “a third less” and the host of eleven would be “a third more” (measured by itself). There seems, however, to be a conscious play on words here, for in the next stanza the “deficiency,” *nyūnatā*, is explained as *gunahīnam* or a moral lack.

In vituperation, which exercises the epic poets a good deal, it is customary to say that an opponent is not worth a half, a quarter, or a sixteenth of the other man. In praise, on the other hand, one says that the object of praise is worth one and a half of the other. One sixteenth, expressed either as “sixteenth particle” or simply a particle or a particle-part, denotes the smallest part usually taken into account. The word gives the last imperishable fraction of the moon visible before it disappears (xii. 305. 4, so the pure soul, *kalā sūkṣmā*, ib. 6 and 335. 40). The adjective full is sometimes added to the part. Twice this fraction is exceeded, once by saying that one eighteenth will not express the relation of inferiority, once by descending to one hundredth part to express contempt. Apart from vituperation, the “sixteenth particle” is employed in a few old phrases. It is found also in Manu and in Buddhistic literature. Examples:

- i. 100. 68, *agnihotram trayī vidyā santānam api cā 'kṣayam sarvāṇy etāṇy apatyasya kalāṁ nā 'rhanti ṣodacīm.*
- ii. 41. 27, *iṣṭāṁ dattam adhītaṁ ca yajñāc ca bakuḍaśināḥ sarvam etad apatyasya kalāṁ nā 'rhanti ṣodacīm.*
- iii. 91. 23, *na sa Pārthasya saṅgrāme kalāṁ arhati ṣodacīm.*

So iii. 174. 3; 254. 27; 257. 4 (your sacrifice is inferior); vii. 36. 7 (the army); vii. 111. 30¹. With *pūrṇa*: iv. 39. 14, *na cā 'rjunah kalā pūrṇā² mama*, “Arjuna is not (as much as) one whole (sixteenth) part of me;” v. 49. 34, *nā 'yam kalā 'pi sam-pūrṇā Pāṇḍavānām*, “he is not even one whole (sixteenth) particle of the Pandus.” So in vii. 197. 17,

yāḥ kalāṁ ṣodacīm pūrṇām Dhananjaya na te 'rhati.

¹ In the next stanza, *nā 'lam Pārthasya saṁyuge* (rare genitive), “not equal to.”

² So I read (compare the next citation). PW. accepts the text, *kalā-pūrṇo*, s. v.

In viii. 15. 28 it is said, "all weapons are not worth a sixteenth part of him." As an equivalent of $\frac{1}{16}$, *prastha* ($\frac{1}{16}$ of a measure) is used where it is appropriate, xiv. 90. 7, "this sacrifice is not equal to a *prastha* of grain of (given by) a man living by glean-ing corn," *saktuprasthena na tulyah*.

In religious writing, besides the phrase above is found a (Buddhistic) comparison, repeated, xii. 174. 46; 177. 51; 277. 6:

*yac ca kāmasukham loke yac ca divyam mahat sukham
trṣṇākṣayasukhasyā 'te nā 'rhataḥ ḡodacīm kalām.*

This stanza is in fact attributed to the same Buddhistic king who sings of his happiness in having nothing, and it is associated with that famous stanza in the last two passages. In the same way is used *kalā* alone:

*açvamedhasahasrasasya vājapeyaçatasya ca
yogasya kalayā tāta na tulyam vidyate phalam,
xii. 324. 9 (a Yoga improvement of Spruch 791).*

I have found the "sixteenth" phrase but once in a *triṣṭubh* stanza, with a slight alteration in form and sense (truth sur-passes all possessions):

*iii. 34. 22, rājyam ca putrāc ca yaço dhanam ca
sarvam na satyasya kalām upāiti.*

A curious account of the distribution of the world's wealth in vi. 6. 23 asserts that Kubera has one quarter of the valuables of Meru, out of which he dispenses one particle-part to mankind, equivalent to one sixty-fourth of all, as in the case of Kali's virtue (above):

*tasmāt kubero bhagavañc caturtham bhāgam aṣṇute
tataḥ kalāñçām vittasya manusyebhyah prayacchati.*

Examples of other fractions in scorn: i. 201. 13, (*yuddhe*) *Rādheyasya na pādabhāk*, "not worth a quarter of him;" iii. 253. 9, *na cā 'pi pādabhāk Karṇāḥ Pāndavānām* (*dhanurvede*); vii. 76. 1, *teṣām viryan mamā 'rdhena na tulyam*, "their power is not equal to half of me;" xii. 155. 6, *kalām aṣṭādaṣīm¹ prāñair na me prāpnōti mārutāḥ*; x. 12. 17, *na samā mama vīryasya çatāñçenā 'pi piṇḍitāḥ*, "they all together are not equal to one hundredth part of my power."

¹ This $\frac{1}{8}$ for the older $\frac{1}{16}$ is a pseudo-epic alteration of the old phrase. It occurs in the Wind and Çālmali fable.

A back-handed boast of Karṇa, which, I think, the poet intentionally makes incoherent, is that of viii. 43. 9, *rte ḡalyasahasreṇa vijayeyam aham parān*, “I could conquer the enemy without (the help of) a thousand ḡalyas,” i. e., “I am equal to a thousand ḡalyas,” or rather “without ḡ., a thousand times over.” ḡalya mockingly replies that Karṇa talks nonsense; whereupon Karṇa returns “more and double abuse,” *paruṣāṁ dvigunām bhūyah*.

On the other hand, in lauding a friend, one and a half is the norm of comparison, as in the following examples:

vii. 72. 34, *mayā 'dhyardhaguṇah* (*putrah*), “my son is equal to me one and a half times over” (sometimes simply “equal to me”).

xi. 20. 1, *adhyardhaguṇam āhur yam bale . . . pitrā tvayā ca*, “who in power they say is equal to one and a half times his father and you” (Kṛṣṇa!). But the comparison, too, is once used scornfully:

ix. 33. 19, *adhyardhena guṇene 'yam gadā gurutarī mama na tathā Dhārtarāstrasya*, “this club of mine is one and a half times heavier than that of D.”

Apart from this belligerent use, one and a half is used of measurement of numbers, i. 1. 103, *adhyardhaçata*, “having one hundred and fifty;” of land, viii. 88. 10, *adhyardhamātre dhanusāṁ sahasre*, “on (land) measuring one and a half thousand bow-lengths;” v. 8. 2, *tasya senāniveço 'bhūd adhyardham iva yojanam*, “his camp was about a league and a half.”

In reckoning interest, *pādikām çatam* is twenty-five per cent., but the verse in which this occurs, ii. 5. 78, *pādikām ca catain vṛddhyā dadāsy ṛṇam anugraham*, has a varied reading, *praty ekām ca çatam* (metrical for *prati çatain ca ekam*).¹

As observed above, the current words for fraction are *pāda*, *bhāga*, and *aṅça*. In xiii. 26. 97, appears in this sense *ekadeça*, a single part of a whole: *udāhṛtaḥ sarvathā te guṇānām mayāi 'kadecaḥ . . . çaktir na me . . . guṇān sarvān parimātum*, “a single part of (Ganges’) virtues I have told thee, I cannot count them all.”

¹ The later epic, by the way, has two coins not previously recognized, besides the Roman denarius (implied), namely, the *kākiṇī* and *asṭāpadapada* (a gold *kārṣapāṇa*), xii. 294. 16; 299. 40.

DIMENSIONS, TERMS, VALUES, SYNTACTICAL CONSTRUCTION.

The usual dimension, *parimāṇa*, mentioned in the epic is length, and with few exceptions distance (length) or height is the *pramāṇa*, a general word for size and extent. Certain measurements are made in the case of the few small things measured, but short distances are loosely cast in such forms as "near by," "not far," "within sight," or "within hearing," and indefinite smallness of extent in the same natural manner is described as "not an atom," "nor a bit," etc.

Distance: *teṣāṁ samṛgravāne*, "within hearing of them," xv. 18. 21 (ib. 20, *avidūrataḥ*, "not far off," like *samīpataḥ*, "near," with genitive; also with ablative, *nā 'tidūrenā naga-*
raṁ vanād asmād dhi lakṣaye, i. 151. 44; *avidūre vanāt*, 152. 1; *na dūram vanāt*, 154. 35; *abhyāce*, 156. 10, "in the neighborhood"); *āgramam prati, utsasarja garbham*, i. 8. 7, "near the asylum"; also *antikam* and *antike*, according to the verb. In the case of *sakāca*, "with(in) sight," proximity, the original sense in many cases has well-nigh disappeared, *mātuḥ sakācāt*
tām cāpām grutvā, "hearing of the curse on the part of his mother," i. 37. 1.

The Rāmāyaṇa has another, more modern, phrase to indicate proximity, namely *mūla*, as in *ahām gamiṣyāmi Yamasya mūlam*, v. 28. 17; *mama mūlam*, ii. 64. 49, which belongs rather to Purānic than to epic diction.

Extent: *na tasyāḥ sūkṣmam api*, "no (superficial) atom of her," i. 211. 16; *na tasya kāye antaram*, "no space on his body," iii. 21. 7; *hayanāṁ nā 'ntaram*, "no interval between the horses," iii. 172. 6; *chidram na rathayoh*, "no chink between the two chariots," i. 226. 3. Indeterminate size is given by compounds, much as in English, *gajā acalasaṅkācāḥ*, "mountain-size elephants," xv. 23. 9, etc.

The verb extend, *āyam*, is used of extending a circle, synonymous with *utsarj*, *maṇḍalam utsrjya*, v. 195. 15. The circumference is *pariṇāha*, the diameter, *viśkambha*. To express the idea of equal distance from a center, the term usually employed is *samanta*, "on every side," in adverbial form, *vedi samantāt pañcayojanā*, "five leagues on every side," iii. 129. 22. Generally, the geometrical figures implied by battle-arrays, called *vyūhas*, are described in figurative language, as a bird, a

needle, a dolphin, and the troops are stationed on the beak, tail, and wings. Thus *karṇa*, ear, becomes “corner” in vi. 60. 10, *oatuṣcaturvyālasahasrakarṇah*, “(an array) with four thousand elephants on each corner” (N. *karnesu vidigbhāgesu*). But there is a peculiarity here in that no figure has been mentioned, and according to the account this array should be like a former one of crescent shape with two horns, *çrñge*, but, not to speak of the plural, we cannot take this statement too literally, and I do not know that *karṇa* is even cornu.

A *çrñgāṭaka*, named from a triangular nut which has “horns,” is used to describe one of these *vyūhas* in vi. 87. 17, and may be a triangle, though here also the scholiast gives the usual epic meaning “shaped like a four-road place,” just as at iv. 68. 25, *catuspatha*, etc. A triangle is *trikona*, *τρίγωνος*, (*triguna*), of the *garuda*, late, as explained in my *Great Epic*, p. 372. A city square is a “four place,” *catvara*, xii. 69. 52, squares and markets being mentioned together in descriptions of cities. In xii. 73. 21, in antithesis to the whole, *kytsna*, city, this word may mean as in English a town-quarter; but in xii. 86. 8, *catvarāpanaçobhita* is simply “beautified by squares and markets.” The “four” of a square is used also to give the idea of a four-square house, *catuhçāla*, and *anta*, boundary, is also used to imply a square, as in *daçakîskusahasrāntā*, of a hall, “ten thousand cubits square,” a meaning made clear by a parallel passage, where *samantāt*, “on all sides,” is expressly added, ii. 1. 21; 3. 23, and no circle can be intended. Earth, *caturāntā*, “has four boundaries,” that is, it is bounded by the “four seas.” In xiv. 64. 10, a camp is *satpada* or *satpatha* (and *navasamīkhyāna* or *sāmsthāna*), with three streets running north and south and three east and west, according to the scholiast; but in xv. 5. 16 he explains *satpadam puram* as having six (traversable) places within the seven walls (up to the inner city), which is not a likely meaning, since the word is followed by *sarvatodīgam*, “in all directions.” Octagonal is *aṣṭāgrī* and other numerals are used with the same word, but only of edges, eight-edged posts and clubs.

Land is measured by bow-lengths (above), and by cow-hides, *api gocarmamātreṇa bhūmidānena pūyate*, “purified by giving even a cow-hide measure of land,” xiii. 62. 19; and the length of a cord is measured in the same way, *na tām vadhrī pariṇahec*

catacarmā, “a cord of a hundred hides could not encircle it,” i. 30. 23. A “span of land” and “as much land as a needle’s point could cover” are contemptuous terms.

From these general methods of measurement I turn to the more exact specifications found in the epic, arranging them on an ascending scale of comparison, from the “smallest finger” to the indefinite *yojana*, which is best rendered league, because its length varies like that of a league, while it approximates most closely to the three-mile league, though it ranges from that extent to about ten miles, according to later authorities; but nothing in the epic determines its length.

Finger-measurement: A thumb-joint serves as the measure of a small bit in general, *añguṣṭhaparvamātrā garbhāḥ*, i. 115. 20, and “thumbkin” spirits are perhaps conceived as being of thumb-size in relation to breadth as well as height. God himself, as a spirit, is measured by the size of a thumb-joint, *hṛdayam sarvabhūtānām parvanā 'ñguṣṭhamātrakah*, xii. 313. 15; as all spirits are described as *añguṣṭhamātra*, thumb-size.¹ All shortest measured distances are calculated by this norm, usually by twos and fours, the application showing, however, that “two thumbs” and “four thumbs” refer to thumb-breadths. Thus there is a stereotyped battle-phrase, *na tasyā 'śid anirbhinnam gātre dvyañgulam antaram*, “there was not an unwounded space of two thumbs on his limb,” vi. 119. 86; 175. 54; iv. 55. 5 (v. l.); xii. 77. 27. The same phrase is found in R. vi. 45. 20, with the verb of the *Virāṭa* passage but with only one “thumb”: *na hy aviddham taylor gātre babhūvā 'ñgulam antaram*, perhaps to be corrected as in Mbh. Earth is flung up “four thumbs,” *caturañgulam*, by a chariot, viii. 90. 106. In a late scene, Yudhiṣṭhira’s chariot floats four thumbs from the earth, *pr̥thivyāç caturañgulam ucchritah*, vii. 190. 56.

The “littlest finger” serves as a comparison in the description of xii. 127. 7–8 (Tanum):

*anyāir narāir mahābāho vapuṣā 'ṣṭaguṇānvitam . . .
carīram api rājendra tasya kāniṣṭhikāsamam,*

“eight times in shape compared with other men (i. e. eight times as tall),² the body being (slender) as the littlest finger”;

¹ References in my *Great Epic*, p. 32.

² A man’s height is often given by saying how many cubits he has (as below). For tall and short are used *prāñcu* and *hrasva*, respectively,

where the poet has to change the regular form of the word *kan-iṣṭhikā* on account of the meter. I do not know whether in i. 52. 7, snakes that are the size of a *gokarṇa*, in antithesis to those that are leagues long, *gokarnasya pramāṇataḥ*, *kroṣayojanamātrāḥ*, are imagined to be the length of a *gokarṇa*-arrow or of a thumb-and-finger-span, a late meaning of the word. When subsequently re-described, they are *yojanāyāmavistarā* (also a Rāmāyaṇa phrase) *dvijoyanasamāyatāḥ*, i. 57. 23, that is, measured by leagues only.

Hand and span: The triangular altar referred to above is described as “of eighteen hands,” *astādagakarātmakah*, xiv. 88. 32. The hand, however, is usually reckoned as a two-span cubit and not as a hand-length. Probably the “hand-tip” gives a double-span, for in the description of a slender woman it is said that her waist measures “a hand-tip,” *karāgrasammitam madhyam*, iv. 13. 22. So in xi. 18. 5, *anavadyāñgī kara-sammitamadhyamā*, “of irreproachable form, measuring a ‘hand’ about the waist.” This measurement shows that the *kara* is equivalent to the *hasta*, a synonymous term, and equal to about a cubit (eighteen inches nominally, but perhaps only about sixteen), “eighteen inches round the waist” being (as I am informed) the boast of slender maids to-day, and Hindu women being petite. Double this length, two *hastas*, is given in Hindu tables as the circumference of a man’s body, about the average thirty-four to thirty-six-inch waist.

The span, *prādeṣa*, is used of the measure of the breast about the spirit: *prādeṣamātre hr̥di nihsṛtam yat*, “what is made manifest in the span-measured breast,” xii. 246. 28, that is, in the vital circle, measured as twelve thumbs in extent from the center; a late view if this reading be accepted.¹ Elsewhere the *prādeṣa* is mentioned a few times in the epic, but never in such a way as to betray what is meant. It measures, for example, the difference in height between the Pāṇḍus and other men, and

jajñe cāilaguruḥ prāñçur mahimnā prathitaḥ prabhuḥ, ix. 51. 34; the fever born of Çiva’s sweat is a *hrasvo ‘timātram* (“excessively short”) devil, xii. 284. 40.

¹ Reading *prādeṣamātram* we should have a reflex of Chānd. v. 18. 1; Māitri, vi. 38. The Āditya Purāṇa, cited by Colebrooke, *Essays*, vol. i. p. 539, says that Vyāsa makes the *prādeṣa* only one thumb-breadth, and not ten or twelve, as taught by others.

between Bhīṣma and Arjuna, for “Bhīṣma in size was more by a span than Arjuna,” *pramāṇato Bhīṣmasenah prādeṣenā ’dhiko ’rjunāt*, v. 51. 19, and (the same expression except for the instrumental case) in v. 169. 8, the Pāṇḍus are a span taller than all others, *prādeṣenā ’dhikāḥ pumbhir anyāis te ca pramāṇataḥ*.

Another word for span is *vitasti*, whence the arrows “called span-long,” *vāitastikā nāma*, used only by special warriors at short distances in the descriptions of the late seventh book and nowhere else till they are met with again in the *Harivana* and in the later *Rāmāyaṇa*. Thus in vii. 191. 42 and in R. vi. 49. 49 of the Gorresio edition, but not in the Bombay text. This is one of the many little indications that show how close Drona stands to the latest additions made to the epic. On the other hand, it helps to a terminus ad quem to find that *hasta* is never used for a measure in the epic, though common in the *Purāṇas*, and reckoned as two *vitastis* or twenty-four thumb-breadths.

Cubits: The cubits mentioned are *kışku*, in vii. 134. 10, “a club of four cubits,” and *aratni*, in i. 167. 25, “a bow (of Drona) of six cubits” (*catuskışku* and *şaṭaratnidhanuh*, respectively, as possessive and determinative compounds). Post-epical authorities (cited by Colebrooke) make the *aratni* equal to twenty-one thumb-breadths, and two *aratnis* are one *kışku*; though some reckon a *kışku* as equal to four cubits. In vii. 175. 19, both these names, as if synonymous, are united in the description of a demon’s bow, “a twelve-cubit-bow a cubit round,” *vyaktam kışkupariṇāham dvādaṣāratnikārmukam*. Arjuna’s bow, i. 189. 20; v. 160. 108, is as long as himself, *tālamātra*, “palm-tree tall,” a common though indefinite measure, which according to i. 197. 39 is the height of all the Pāṇḍus. The five-cubit (*kışku*) bow of x. 18. 6 is allegorical but may indicate the usual length. Arrows are “axle-long,” *akṣamātra*, *passim*, and the *añjalika* arrow mentioned in viii. 91. 41 is three cubits, *tryaratni*. A later form, *ratni*, is used in this same book. Here, viii. 72. 30, it is said that Karna was *asṭaratnih*, “eight cubits” tall (in iii. 126. 32 a man “grew thirteen cubits,” *avarḍhata kiskūn trayodaṣa*, but he was Māṁdhātar, and enjoyed peculiar nursing). We might almost suppose that this so-called cubit, whether *kışku* or *aratni*, was really a foot, or about twelve inches instead of eighteen. For the actual length of

Hindu bows and arrows are for the ordinary bow five feet and for the ordinary arrow two and a half to three feet (*Ruling Caste*, pp. 270, 276), and both five and six “cubits” are the size of the epic bows, while the one arrow measured is given as three cubits, the heroes being a little above but not much over the normal height and only Karṇa being of eight *ratnis*. Even he is not extolled as a giant, as a man of eight cubits would be. “Palm-tree tall” and another phrase used of the heroes, *cāla-stambhā ivo ’dgatāḥ*, “lofty as Cāl trees,” v. 169. 7, are more grandiose than exact. As the later schemes reckon the cubits in thumbs (or fingers), the twenty-one and twenty-four thumbs that go, respectively, to an *aratni* and *hasta* must be estimated by the size of a Hindu hand, which at present is rather small. Further, the relation between thumb-joints and span, reckoned as from the end of the thumb to the outstretched fore-finger, is given as twelve, which is too many, for the distance corresponds rather to the relation between the span and the finger-breadth. Reckoned as eight inches, a normal span, the later cubit would be nearer sixteen than eighteen inches and the *ratni*, being still shorter, would not be much over a foot. According to the Suṛuta, a man’s height is one hundred and twenty thumbs, i. 126. 11, or ten spans, which at nine inches to a span would make the average Hindu seven and a half feet tall and at seven inches would still make him nearly six feet.

Foot and Pace: The measure by foot-pace is almost confined to a conventional “eight paces,” *padāni*, often used in battle-scenes, but always, if I am not mistaken, in the same way, *āplutya*, or *abhyetya*, *padāny asṭāu*, as in vii. 15. 28; ix. 12. 20. Even a deer “went eight paces and then turned,” *tataḥ sa harino gatvā padāny asṭāu nyavartata*, xii. 273. 14. According to the Mārkanḍeya Purāṇa, cited by Colebrook, *Essays*, vol. i., p. 539, a *pada* is a foot-breadth and not a pace, being only half a *vitasti* span or six fingers (thumbs). In the epic, as in “seven paces” in the marriage-rite, and in the colloquial phrase *pade pade*, “step by step,” the word means a general pace-length or step. “Not a step” is almost equivalent to the French *ne pas*; for example, *nā ’kampata padāt padam*, “he did not budge a step” (at all), a common phrase, as in ix. 57. 46. The later epic has *padakam padakām canāih*, “step by step, slowly,” xiii. 53. 35, and another passage has *ekapadam* in the sense of “in one word,” iii. 313. 69.

Arms and fathom: Estimated at four or five cubits in later works, the *vyāma*, space between the outstretched arms, is used a few times, but only of trees and sacrificial appurtenances. A bough *daçavyāma*, ten *vyāmas* long, is mentioned in a repeated phrase, iv. 23. 21, etc., and a *vedī daçavyāmāyatā navotsedhā*, “ten *vyāmas* long and nine high,” in iii. 117. 12; while the circumference of a sacrificial post, as made in the good old days of marvels, is given as one hundred, *yūpah catavyāmah pariñāhena*, vii. 68. 12. The divine discus of Kṛṣṇa is *vyāmantara*, which the scholiast says is “five cubits, the space between the outstretched arms,” *prasāritayor hastayor yāvān vistārah pañcāhastamitah tīvat*, v. 68. 2. It may be called in general (cf. Çat. Br. i. 2. 5. 14, etc.) a sacerdotal measure, not employed in the tables, and, except for the measurement of trees, it keeps this character in the epic.

Rods and Bows: Another sacerdotal implement was the *çamyā* rod, the cast of which, according to the epic, measures the interval between the altars set up by a very pious man. The rod, according to the scholiast, is pointed at one end and has a thick knob at the other, and is thirty-six thumbs, two and a half statute cubits, in length. When one “sacrifices by the rod-cast,” one goes around the earth sacrificing at intervals, which are measured by the distance a strong man can fling the rod, *çamyā* in the epic, or, according to the scholiast, *sampā*, from its fall, *sampatati*. The technical expression is *çamyākṣepena* (*vidhinā*) or *çamyākṣepātih* (*devān yajati*), “sacrifice to the gods by the cast of the rod,” iii. 90. 5; xii. 223. 24; xiii. 103. 28. The only varying usage is found in iii. 84. 9, where a Tīrtha is described as being “six rod-casts from an anthill,” *ṣaṭsu çamyānipātesu valmikāt*, but this is still in a sacerdotal connection. Measure by arrow-casts is confined to estimating time, as will be shown hereafter.

Bows are used for measurement, but the epic examples give no clue to the length, though later authorities reckon this as equal to a staff, *danda*, or four cubits, which must be regarded as the length of a bow (six feet). In the three epic cases, two forms of the word are used, *dhanus* and *dhanu*: “dragged eight *dhanuṇi*,” i. 153. 40; “struck ten *dhanvantarāni*,” viii. 83. 9; “land measuring one and a half thousand of bows,” *dhanuṣām*, viii. 88. 10 (cited above, p. 137).

Yuga: This is said to be a measure of four cubits. In iii. 296. 10, *yugamātrodite sūrye*, “when the sun is up a *yuga*” (N. *yugam hastacatuṣkam*), when the matutinal-rites are performed (*krtvā pāurvāñnikīḥ kriyāḥ*). I have not found the word elsewhere in this sense, and as a measure it does not appear to be an old term.

Nalva: I am not aware that the *nalva* or *nala* is an early term of measurement. In the great epic it is confined to the seventh book and to the mass which I call pseudo-epic, especially to the *Harivāṇa*. It is, further, not in the *Rāmāyaṇa* in its earlier form but it has been added to it in the later re-writing of that poem. The word epitomizes the gradual growth of the epic. The Bombay text has *nala* and *nalva*, but not without metrical reason for the choice. We find in vii. 70. 16 (the latest addition to the chronicles of kings), *vedīm astanalotse-dhām*, which is repeated in xii. 344. 60. In the former case it is defined by the scholiast as four cubits; in the latter, as a finger, with *tala* as v. 1. Again, vii. 156. 58, *mahāratham triṅcannalvāntarāntaram*, and, in a scene which in many points is a mere repetition¹ of this, vii. 175. 12, *nalvamātram mahāratham*, which is repeated in 176. 15 (written *nalla* in these two verses in C.), but nowhere else till we get to xii. 29. 143, where, also in the chronicles of the “kings that died,” we find that Pr̥thu Vāinya gave to the priests *hāiranyāns trinalotsedhān parvatān ekavīṇçatim*. It is interesting to see that the Drona account of the “sixteen kings,” in adding the sixteenth, has taken from Pr̥thu this laudation and inserted it in the next and last (lacking in Čānti). In vii. 62. 13, the phrase is *hāiranyān yojanotsedhān āyatān cātayojanam*, giving height and length. In the cases cited it will be observed that *nala* is not simply a *falsche Schreibart* (PW.), but a necessary metrical alteration (*nalla* alone being wrong). In xii. 154. 7, a tree is *nalvamātrapariṇāhah* (where N. defines the measure as *hastā-nām cātacatuṣṭayam*, which removes the doubt expressed in PW. as to *catuḥçatam*), “four hundred cubits in circumference” (this attributes the greatest circumference to the tallest

¹ It repeats the preceding text, but *adhyāya* 175 is the original. Besides the one *nalva* raised to thirty in 156, we have the *cakra*, which in 175. 46 has still only 1000 spokes while in 156. 77 it has 100,000.

tree known, the *cālmali*). A Kālāmra tree is *yojanotsedhah*, vi. 15 (*not* a Dvīpa, PW., but a tree that gives perpetual youth). A following stanza tells of another wonder-tree, estimated as being one thousand and one hundred leagues tall, which measures the *utsedha* or height from earth to sky, vi. 7. 21. Its circumference is “of *aratnis* one thousand and hundreds ten and five” (2500 cubits).

Kroṣa : The *kroṣa*, Anglo-Indian *koss*, which means literally a “scream” and is estimated in later works as two thousand “bows” or a fourth of a *yojana*, is the usual number to indicate travelling distances, not in multiples but always as a *koss*, as if one always went just one *koss* unless he went at least as much as half a *yojana* (rare, ii. 2. 22, *yojanārdham atho gatvā*, in accompanying a departing guest) or a *yojana*, which latter is used for all long stretches. The almost universal use of *yojana* for this purpose rather than two or three *koss* would indicate that the *yojana* was shorter than is usually assumed. It is not often that a *koss* indicates height, but the examples below will show one case of mountains thus measured. For journeys, besides the use of the half-league in the example just given and the league, as in vii. 112. 12, *itas triyojanam manye tam adhvānam . . . yatra tishthati*, “I think it is a course of three leagues from here (to) where he stands,” we have in the following examples the regular (single) *koss*: iii. 271. 53, *kroṣamātrāgatān aṣvān*; vii. 99. 9, *rathe kroṣam atikrānte*; ix. 29. 42, *kroṣamātram apakrāntah*; xi. 11. 1, *kroṣamātram tato gatvā*. In other measurements: vii. 103. 37, *tasthāu kroṣamātre samantataḥ*, “at a distance of a *koss* on every side.”

A great archer shoots a *koss*: “He seized several arrows and when he had fitted them to his bow quickly as if they were one, they fell at a distance of a *koss*,” *kroṣamātre nipatanti*, viii. 79. 57; *rathasthito grataḥ kroṣam asyati ṣarān*, vii. 99. 9. Mountains “raised a *koss*” are mentioned in vii. 65. 10, *parvatāḥ kroṣam ucchritāḥ*. Most of the other cases of the use of *koss* are quite as useless in helping to a determination of its real length. They are as follows: For a *koss* on every side around a beleagured city the earth is broken up and mined, *samantāt kroṣamātram*, iii. 15. 16; ponds are of this extent, *vāpyaḥ kroṣasammitāḥ*, vii. 56. 7; the heroine can be smelt up to a *koss*, *gandhač cāsyāḥ kroṣamātrāt pravāti*, i. 197. 36; *kroṣāt pradhāvati*, i.

167. 46 (see below on *yojana*). The only passage that seems to cast light on the epic measure is found in xiii. 90. 37, where speaking of the purifying effects of the men “fit for the row” and of the *daçapūrusa* (gl. 27), that is, a man tenth in descent in inherited Vedic wisdom (one who has nine generations of pious and learned ancestors), the poet says: “They purify as far as they see . . . even one such would purify to a distance of two and a half *koss*,” *yāvad ete prapaçyanti pañkyās tāvat punanty uta . . . kroçād ardhatrtyāc ca* (above, p. 133) *pāvayed eka eva hi*. Here, as two and a half *koss* are regarded as less than the limit of ordinary ability to see a person, and five and a half miles far exceeds this, it would seem that in the epic the *koss* was not two miles and a quarter but nearer one mile, as is the estimate of the Viṣṇu Purāṇa (which ascribes to it, Colebrooke, *loc. cit.*, four thousand cubits, a thousand bows, against the Āditya Purāṇa’s estimate of eight thousand cubits), or, exactly one mile and one eighth rather than two miles and a quarter. This, however, is based on two surmises, first, that the “even one” clause introduces a restriction applicable also to the distance as less than that previously mentioned, which seems to me legitimate, and, second, that the expression “as far as they can see” means as far as they can see a person (that person becomes pure by being seen). This latter surmise also seems to me to rest on the intended meaning, though it is possible that the expression merely means as far as eyesight can reach, in which case the passage is as useless as the others.

Gavyūti: After the *koss* comes the *gavyūti*, estimated by later writers as two *koss*. It is used in the epic to give distance, *gavyūtimātre nyavasat*, “stayed at a distance of four miles,” iii. 239. 29; and, in the bombast of the late book of Drona, the battle-array is estimated as extending twelve *gavyūtis* or forty-eight miles, *dīrgho dvādaçagavyūtiḥ* (*paçcā 'rdhe pañca vistrtaḥ*, and twenty in the rear), vii. 87. 22, a statement the more remarkable as the whole battle-field is only five leagues in extent, v. 195. 15. In vii. 87. 14 is found also the expression, *gavyūtiṣu trimātrāsu* (*tishṭhata*). The *gavyūti* is seldom used for travellers, but often for stationary extent of hall, camp, and quiescent distance, as in xii. 125. 18, where a deer springs ahead, but stands a *gavyūti* distant, *gavyūtimātrena*, *bāñapatham muktvā*, *tasthivān*. At least, it is not till the

late “house of lac” scene, i. 151. 20, *gavyūtimātrād āgatya*, “coming up to a distance of a *gavyūti*,” and in the (also late) scene at (Gorresio) R. i. 79. 27, *gatvā gavyūtimātrakam*, that I find it with a verb of motion. This is doubtless because of its meaning originally a meadow, that is a field or acre, rather than a measure of length. According to Nilakantha, *goyuta* is the equivalent of *gavyūti*, as used in xiv. 65. 22, *goyute goyute cāi 'va nyavasat*, “he rested (camped) at every *gavyūti*,” designating a daily march retarded by the weight of treasure carried. In any case the term is a solecism. A march like this, by the way, is described as being made *kramena*, step by step, “slow march,” xv. 23. 16.

Yojana: The “yoking” called *yojana*, estimated at two *gavyūti*, four *koss*, eight thousand bows, and consequently sixteen thousand cubits in the Āditya Purāna, is reckoned in the Viṣṇu Purāna as only half of this distance, that is, as nine miles in the former and four and a half in the latter work (Colebrooke, *loc. cit.*), but in the Mārkaṇḍeya Purāna as four *gavyūti* or eight *koss* (*cit. PW.*). I shall render it league. It is the longest measure and is used in estimating extent of length and surface. As the syntactical construction of this word includes that of all the others previously mentioned, I have reserved the subject for this paragraph. The construction varies between adjective compounds in the modifying word, adjective compounds with *yojana*, and accusative (nominative) or ablative of extent, as follows:

i. 30. 23, *sa tataḥ çatasāhasraṁ yojanāntaram āgataḥ kālena nā 'timātreṇa*, “in a short time he went a hundred-thousand league-interval,” i. e. a distance (measured by) a hundred thousand leagues.

xiv. 9. 34–35: *sahasraṁ dantānāṁ çatayojanānām . . . dañṣṭrāç catasrā dve çate yojanānām*, “a thousand of hundred-league teeth . . . four fangs two hundred of leagues.” i. 175. 43, *tat sāinyam kālyamānam triyojanam*, “the army was driven three leagues;” xii. 170. 15, *itas triyojanam gatvā*, “going three leagues from here.”

ii. 7. 2: *vistīrnā yojanāçataṁ çatam adhyardham āyatā . . . pañcayojanam ucchritā*, (a hall, *sabhā*) “one hundred leagues broad, one hundred and fifty long . . . five leagues high;” ib. 8. 2,

çatayojanā vistārāyāmasampannā bhūyasi cā 'pi, (a hall) “of a hundred-leagues, complete in breadth and height, and even more”; ib. 10. 1, thus in B:

*sabhā Vāigravaṇī, rājan, çatayojanam āyatā
vistīrnā saptatiç cāi 'va yojanā 'tisitaprabhā,*

where C. has *yojanāni sitaprabhā*. C. has the right reading; the construction is “broad, seventy leagues” (in the nominative), and not “seventy were broadened” (leaving *yojanā* to be construed as a Vedic form with *saptatiç*), for the construction throughout, as is customary with *vistīra* and *vistrta*, is to make *vistīrnā* agree with *sabhā*.

Ordinarily, the accusative, as in *kroçam ucchritah* (above, p. 146), expresses the extent, and this may be assumed to be the construction when the form leaves the case ambiguous, as in the answer to the question, “How long is the road between the world of Yama and the world of men?” (given as) “between (etc., is) eighty-six thousands of leagues,” *Yamalokasya cā 'dhvānam antaram mānuṣasya ca kīdrçanī kim pramānañ vāi? sadaçitisaḥsrāñi yojanānām narādhipa Yamalokasya cā 'dhvānam antaram mānuṣasya ca*, iii. 200. 44 and 46. Here it is clear that the numeral is in the accusative, and it is probably governed, as is *adhvānam*, by *gantavyam*, as in the following: *kiyad¹ adhvānam asmābhīr gantavyam imam idṛçam? etāvad gamanām tava*, xviii. 2. 26 and 28. The locative may take the place of the accusative when the word “way” is used, as in xiv. 27. 3, *kiyati adhvani tad vanam*, “(on) how great a way is that forest?”

I do not find the nominative used to measure distance of movement (evidently because it is impossible to say one goes to a nominative) but only of stationary distance, that is, where no progress toward is implied. For example, one may not say the way is a *kroçah* but only *kroçam* by analogy with “one goes a *kroçam*.” But, as in the example above, one may say a hall is extended so much and use the nominative, because the word extended does not mean goes to that distance; but extended is broad, and this ptc. adj. is equivalent to the noun breadth.

¹ But *kiyantam kālam*, ib. 5. 4. There is a passage, i. 126. 8, where *adhvan* appears as a neuter, *prasannā dīrgham adhvānam saṅkṣiptam tad amanyata* (N. supplies *gamanam*).

So in estimating the (stationary) height of a mountain one says that it is “upraised” so much in a compound preceding, as in *ṣadyojanasamucchritah* (*Kālāsaḥ*), “a six-league-upraised” (mountain), iii. 139. 11; or that it is so many leagues, without anything to indicate that the numeral is not a predicate nominative, as in *trayastrīṇcat sahasrāṇi yojanāṇi hiranyaṁyāḥ*, “golden (Meru is) thirty-three thousand leagues,” iii. 261. 8; *yojanānāṁ sahasrāṇi pañca ṣaṇ Mālyavān atha*, “Mālyavat (is) five-six (eleven) thousands of leagues,” vi. 7. 29;¹ or that it is “upraised” so many leagues in the nominative, as in

*Meruḥ kanakaparvataḥ . . . sc. tiṣṭhati
yojanānāṁ sahasrāṇi caturaçītir ucchritah
adhaſtāc caturaçītir² yojanānām,*

“golden Meru . . . (stands) eighty-four (nom.) thousands of leagues upraised, (and) under(-ground) eighty-four (nom., sc. thousands) of leagues,” vi. 6. 10–11.

Further, there is the one construction where, instead of saying that the height or breadth of a mountain is so much, one may employ partitive apposition with (apparently) a nominative (predicate), as in

*aṣṭādaça sahasrāṇi yojanāṇi, viçāmpate,
ṣaṭ catāni ca pūrṇāṇi viskambho Jambuparvataḥ
lāvaṇasya samudrasya viskambho dviguṇaḥ smṛtaḥ,*

“eighteen thousand leagues and six full hundreds the breadth (is) Jambu-dvīpa, and the salt sea’s breadth (is) recorded (as) twice as much,” vi. 11. 5–6. The ordinary construction in such a case is to prefix the number, if it is easily managed, as part of a compound, as in *ādityaparvatāṁ daçayojanavistāram*, “of ten-league-extent,” xii. 328. 23; or to put the dimension in an oblique case, as in

ekāikam yojanaçataṁ vistārāyāmataḥ samam,

“each (city was) one hundred leagues (of a league-hundred) alike in respect to breadth and length,” viii. 33. 19 (compare *pramāṇāyāmataḥ samah*, of a man, i. 222. 31); but with such

¹ Here occurs a word rare enough in early texts to be noticed, *mahārajata* as gold- (colored people). Cf. *JAO*S., xx., p. 221 for *hiranya* as silver.

² For the meter, cf. No. 37 in the Cloka-forms of my *Great Epic*.

an unmanageable number as that above it is more natural to have the construction of the second part of the sentence a genitive, with the dimension in the nominative.

The locative gives the extent only when this is implied or conditioned by the context, as “on the way” (above) and in *ekādaca sahasrāṇi yojanānām samucchritam, adho bhūmer sahasresu tāvatsv eva pratiṣṭhitam*, (Mt. Mandara), “eleven thousand of leagues upraised, and supported on just as many thousands below the earth,” i. 18. 3. So “at six-rod-casts from the anthill” (above, p. 144), is only a location of place, not of extension; also *kroṣamātre* (p. 146).

Finally,¹ in estimating distance to a certain extent, the ablative may be used with some prepositions to convey the notion of exceeding the limit, or simply, beyond, while the ablative alone or with ā indicates the limit itself up to which the distance implied extends. Of the first case an example is found united with the instrumental in

xii. 336. 9, *Meroḥ sahasrāṇiḥ sa hi yojanānām dvātriṇçato ‘rdhvam kavibhir niruktaḥ,*

“this (white island) is said by the poets (to be) from Meru more than thirty-two thousands of leagues” (by thousands more than thirty-two).

The antique expression *mūlāt*, “up to the root,” is used, though rarely, both in this sense and in that of “from the root,” that is from the beginning, but it is significant that the epic usually expresses the idea by a compound, as in

tataḥ samūlo hriyate nadīkūlād iva drumah,

xii. 95. 21; or it is paraphrased, for example, *na mūlaghātāḥ kartavyāḥ*, xii. 268. 12. Moreover, in words expressing distance, the examples leave it a little doubtful whether the ablative means “from” or “up to,” but by analogy with the same phrase with the preposition it would seem that the latter idea was that of the simple ablative. Thus, to express the idea of a smell extending a *koss* we find *kroṣamātrāt pravāti* and *kroṣat*

¹ Of course I omit idioms which may be translated to give extent without really expressing this, such as *brahmādiṣu trṇāntesu bhūtesu parivartate*, “pervades all beings from Brahman to grass,” iii. 2. 72 (a common phrase).

pradhāvati (above, p. 146); *tasyās tu yojanād gandham ājigh-ranta narā bhuvi*, i. 63. 82; *āyojanasugandhin*, i. 185. 21; and, in the province of sight, *yojanād dadṛce*, ii. 24. 22; *āyojanasudarçana*; and finally, *ā* with the ablative, as in *locanāir anujagmus te tam ā dṛṣṭipāthāt tadā*, “then they followed him with the eyes up to the limit of their vision,” ii. 2. 26. As with time-words, *yāvat* is also used, *yāvac Carmanvatī*, “as far as the river,” i. 138. 74.

Another reason for taking the ablative as one expressing the limit up to (rather than the origin) is that it thus offers a perfect parallel to the use of the ablative with time-words, for, as I shall show in the next section of this article, the idea of a simple time-ablative expressing the time after which any thing occurs is erroneous, though this is the only explanation of this ablative given by Speyer (and adopted by Whitney). On the contrary, the time-ablative, unless expressly accompanied with *ūrdhvam* or its equivalent in the sense of “beyond,” always indicates time up to the limit expressed by the ablative, and so the extent-ablative indicates the extent up to the limit expressed by this case. With *adhi* the ablative means above, over.¹

When the name of a dimension is given, it is usually compounded with the number, and this has led Speyer in his excellent *Sanskrit Syntax*, § 54 a), to remark that “when naming the dimension of a thing one does not use this accus. [of space], but avails one's self of bahuvrīhi compounds.” With few exceptions this is quite correct and as a general rule is perfectly unimpeachable. Thus in iii. 82. 107:

*ardhayojanavistārā pañcayojanam āyatā
etāvatī Devikā tu,*

“of half-league-breadth, five leagues long (extended)—such is the size of Devikā.”

vii. 66. 16, *śatṛiñçadyojanāyāmā² triñçadyojanam āyatā
paçcāt puraç caturviñçad vedī hy āśid dhirañmayī*,

¹ I take *yojanād adhi* in C. ii. 619 in this sense, but B. 14. 54 has *yojanāv adhi* (*triyojanāyataṁ sadma triskhandhaṁ y. a.*), and PW. interprets C. as “a Yojana high.” This preposition, by the way, is used (in a way not recognized in PW. or pw.) with gen. of place, in H. ii. 79. 12, *saptnīnām adhi nityam bhavyeyam*, “over my rivals.”

² C. has *śađviñçad*, cl. 2,349, which inverts the ratio and makes *āyāma*, length, into breadth.

“of thirty-six-league-length, thirty leagues broad (extended), in the rear (and) in front twenty-four (leagues), was the golden *vedī*.”

This arrangement, by which one member is made a compound of the noun of dimension and the other has the participle, is quite a favorite. The following example illustrates it again, together with another illustration of the extent given by a number-word, apparently in the accusative:

xiv. 58. 33, *ito hi nāgaloko vāi yojanāni saharaçah,*
“from here the dragon-world (is) leagues by the thousand;”

ib. 37 and 40, *nāgalokam viveça ha, dadarçā nāgalokam ca yojanāni sahasraçah . . . dvāram sa dadarçā pañcayojanavistāram āyatānī çatayojanam*, “he went to the dragon-world, and he saw the dragon-world, leagues by the thousand . . . and he saw the five-league-size gate, a hundred leagues extended.”

Another example of the exceptional usage, whereby when naming the dimension of a thing one uses the accusative, is given by this case:

xii. 282. 7-8, (*dadarçā*) *Vṛtraiñ dhiṣhitam parvatopamam, yojanānām çatāny ūrdhvam pañcocchritam, arimdama, çatāni vistareñā 'tha trīny evā 'bhyadhikāni vāi*, “he saw Vṛtra stand like a mountain five hundreds of leagues upraised on high (tall), and three hundred more in extent.”

When two dimensions are given, they may follow adverbially, as in one of the examples above and in xii. 339. 9, *çatayojanavistāre tiryag ūrdhvain ca*, “hundred-league-extent (peaks) transversely and up,” that is, two peaks having this extent in both directions; for *vistar*, *vistāra* is extent in general (*ākhyānam bahuvistarām*, “a long story,” vii. 52. 37; *çatayojana-and anekayojana-vistirna*, of ocean, “leagues broad,” iii. 282. 59 and 45), and may even limit, as a general term, *āyāma*, which is always length, as in (*dvijojanasamutsedhā*) *yojanāyāmavistarā*, “(two leagues high and) a yojana-length-extent weapon,” vii. 175. 97 (not in C.).

This last sentence (compare also the *nalva* citations, above, p. 145) gives the regular word for height, which is construed in compound form, as here and in i. 29. 30: *ṣad ucchrito yojanāni gajas taddviguṇāyataḥ kūrmas triyojanotsedho daçayojana-*

mandalaḥ, “an elephant six leagues upraised and twice as extended; a three-league-height and ten-league-circle tortoise” (in English, three leagues tall and ten round).

ON π .

Although no word in the epic expresses the relation between the diameter and the circumference, yet this relation is given in figures, as applying to the size of the sun, the moon, and the “planet” that swallows them, the moon being rather larger than the sun.¹ The account of the size will be found at vi. 11. 3 (Rāhu); 12. 40 ff.; of the cause of eclipse, i. 19. 9 (*rāhu-mukha*). The relation between the diameter and the circumference differs inversely according to the size of the object, the greatest circle having the smallest ratio. Of the three heavenly bodies, Svarbhānu or Rāhu (the devouring planet) is circular, *parimandala*, no less than the moon and the sun, so that π can be established in this case as well as in the others. Its diameter, *viṣkambha* (breadth), is twelve thousand leagues, *yojanas*, and “in its circumference and extent,” *parināhena vipulat-vena ca*, it is “thirty-six thousand sixty hundred” or 42,000 leagues, as say the Pauranic sages, *budhāḥ pāurāṇikāḥ*. The moon’s diameter, *viṣkambha*, is eleven thousand and its circle, *mandala*, is thirty-three (thousand) and “sixty-less-one” (hundreds, given in the text as the *viṣkambha*, but this must be *parināha*, as in the preceding case), making the sum in thousands (33) and in hundreds (59) equal in all to 38,900. The sun in diameter is “eight thousand and two more,” *anye*, and its circle is equal to thirty (thousand), *maṇḍalam trinçatā samam*, and fifty-eight (hundred) in extent, *vipulatvena*, or 35,800. Thus (instead of $\pi=3.1416$):

¹ This is not strange. In fact, the full moon in India on a clear night certainly looks larger than the sun even when the latter is on the horizon. Especially at the end of a dusty day; when the moon seems twice the size even of the harvest moon of this country. But this is not the only reason for the great size attributed to the heavenly bodies as compared with that assigned by the Greeks. Even the stars are regarded as huge worlds “because though small as lamps in appearance they are so far removed” (the passage is given in my *India, Old and New*, p. 59, from iii. 42).

Rāhu, 12,000: 42,000 $\pi=3.50$
 Moon, 11,000: 38,900 $\pi=3.53+$
 Sun, 10,000: 35,800 $\pi=3.58$

There is nothing to indicate that the *yojana* here used is the special astronomical *yojana* of later works. According to the Sūryasiddhānta, iv. 1, the sun's diameter is 6,500 (astronomical) *yojanas*, and the moon's is 480, while π in that work is 3.1623 and 3.14136, according to circumstances (Whitney's notes, *JAS*. vi. pp. 183 and 201). A little later, in the fifth century, Āryabhaṭa (Thibaut, *Astronomie*, etc., p. 75, in Bühler's *Grundriss*) knew that $\pi=3.1416$, and it seems grotesque enough that even an epic poet could give such statements as those made above, if he had an approximate notion of the true relation. For it is not as if the author carelessly (poetically) said that the sun's circumference is about three and a half times its diameter. The numbers are given in detail for three different circles and show that the calculation had been made in each case. But any boy with a string and a tree-stump could get nearer to the true ratio than 3.5.

[To be continued.]